IRON AND COAL
TRADES REVIEW

Vol. 181 December 30, 1960 No. 4,824

Central Heating

CENTRAL heating is a field in which oil is making one of its greatest inroads, and it is an unremitting fight that must be waged if the market is to be retained for solid fuel. Mr. Alfred Robens has set an example of militancy in his recent speeches. He is not prepared to see coal ousted by oil, and the announcement that a vigorous drive for the central-heating market is to be made by the Coal Utilisation Council will act as a stimulant to many who have been wondering what, if anything, was being done.

During the war it was a common criticism of this country's efforts that they were invariably too little and sometimes too late. The programme envisaged by the Coal Utilisation Council may possibly suffer from being a little late, but it would seem to show a determination to see that it shall not be too little. A publicity campaign will not in itself suffice; a concerted effort is required from all who have the interests of solid fuel at heart. There is room for action in several directions.

It is well known that a small chain-grate stoker was successfully developed by the British Coal Utilization Research Association at Leatherhead. It is also common knowledge that the stoker was subjected to a severe test under working conditions for a whole heating season in Battersea, London, and it is understood that the results were highly satisfactory. If this is so, it is a matter for regret that further information has not been forthcoming. It would appear to be of outstanding importance to the National Coal Board that there should be no delay in getting more of these appliances installed. Development and research take time; once success has been achieved, high pressure marketing is essential.

It is a matter of urgency that Government departments, local authorities, architects, builders, and the public in general should be made aware of the fact that solid fuel is still a force to be reckoned with. It is a matter of urgency that fuel distributors should have full knowledge of the position regarding these stokers. They are closer to the consumers than anyone else, and they know that it is not in 1962 or 1963 that the battle for solid fuel will be won or lost, but in 1961. It is a matter of urgency to consumers who are hesitating between coal and oil that they should be in possession of the latest facts.

Other local authorities, we may be sure, are watching the Battersea trials closely, and will be influenced in their choice as between coal and oil by what they learn from these trials. It would be interesting to know whether the initial trials are being followed by further and more extensive trials this winter. With so many interests involved, clearly a concerted drive to get immediate results is essential. The central-heating market is a matter of great moment and immediate concern to the coal industry and trade. The merits of the coal fire are widely publicized. The slogan, "There's nothing so cosy as a nice coal fire" has great appeal. But the appeal is limited in its scope. Publicity must also be directed, and directed in a big way, to those people who are attracted by the prospect of whole-home heating, rather than enjoying the cosiness, undeniable but limited, of an open fire. The Coal Utilisation Council's forthcoming campaign merits the fullest support of coal producers and coal traders, who jointly should make sure that the success of the campaign is not jeopardized by any failure to "deliver the goods."

GKN Steel Companies Amalgamated

ON Monday the iron and steel making companies of the Guest Keen & Nettlefolds, Limited, group, are to be amalgamated under the name of G.K.N. Steel Company, Limited. The business conducted by Guest Keen Iron & Steel Company, Limited, will continue under the name of Guest Keen Iron & Steel Works (branch of G.K.N. Steel Company, Limited).

John Lysaght's Scunthorpe Works, Limited, and its subsidiary, Scunthorpe Rod Mill, Limited, also come under the amalgamation and the undertakings and assets of both companies will be acquired by G.K.N. Steel which will accept and discharge all the liabilities and perform all the obligations of the two companies.

John Lysaght's Scunthorpe Works and Scunthorpe Rod Mill will continue under the name of Lysaght's Scunthorpe Works (branch of G.K.N. Steel Company, Limited).

New Appointments at Electrical Research Association

RESEARCH manager of the British Electrical and Allied Industries Research Association, Mr. L. Gosland, has been appointed deputy director. He will retain his present appointment. Mr. C. G. Garton and Mr. E. W. Golding, have been appointed assistant directors and will continue as head of the materials department and head of the rural electrification department respectively—Mr. Golding also remaining oversea liaison officer.

Dr. R. H. Golde has been appointed head of the surges and transformer department.

NCB Reorganization in Lancashire Areas

ARRANGEMENTS have been completed for the reorganization of the Lancashire Areas of the North-Western Division of the National Coal Board. Three of the present four administrative areas in Lancashire will be merged into two new Areas with effect from January 1, 1961.

The three areas are at present known as the No. 1 (Manchester) Area, No. 2 (Wigan) Area, and No. 3 (St. Helens) Area. The new ones will be known as the East Lancashire and the West Lancashire Areas. East Lancashire Area will have its headquarters at Walkden (present headquarters of the Manchester Area) and will be responsible for all collieries in the Manchester Area, and three at present in the Wigan Area—Bedford, Chanters, and Gibfield.

West Lancashire Area will have its headquarters at Haydock (present headquarters of the St. Helens Area) and will be responsible for all collieries in the No. 3 (St. Helens) Area, plus all the collieries in No. 2 (Wigan) Area except Bedford, Chanters, and Gibfield. The fourth Lancashire Area, the Burnley Area, is continuing as a separate Area for the time being. Preparations are being made to merge it within the new East Lancashire Area later in 1961. Fifth Area of the Division, the North Wales Area, is not affected by the changes.

Wigan Area offices at Kirkless will continue for some time to play an important part in the administration and operation of those Wigan groups and collieries that will in future be within the West Lancashire Area.

Mr. Tom Knowles, Manchester Area general manager, will be Area general manager of the new East Lancashire Area. Mr. Thomas Hulme, St. Helens Area general manager, will be Area general manager of the new West Lancashire Area.

Coal Board to Pay £300,000 Auchengeich Compensation

WIDOWS and children of the 47 miners killed in the fire in Auchengeich Colliery (Lanarkshire) in 1959 are to receive about £300,000 compensation from the National Coal Board—said to be the highest out-of-court settlement in British mining history. Each of the 41 widows will get £4,250 in a lump sum. The 70 children left fatherless will each receive about £1,000. There will be smaller payments to brothers and mothers of some of the men who died.

Negotiations over the amount of compensation payments, which have been going on between the National Union of Mineworkers and the Coal Board for several months, have now been completed. With the NCB compensation, each widow will have received a total of £6,250. Each had a lump sum a year ago from the £172,000 disaster fund, plus £3 a week for each child until the age of 18.

Confirming the settlement, a senior Coal Board official in Edinburgh said: "The final figure has not been settled, but it will be a considerable sum, probably not far short of £300,000. This sum will be set against the operating costs of the industry."

Passing Thoughts . . .

I AM not against workers receiving whatever their bargaining power can achieve. But when footballers, who exert themselves about 90 minutes a week, while the rest of the time they are investing in their own bodily health, are demanding up to £30 a week, I think it is about time we got our priorities in the right order.—MR. ROY MASON, MP, speaking to retired miners of Wharncliffe Woodmoor Colliery.

> *Festivals of Britain: December* 18: Alf Robens' Day, *Keep the coal fires burning* (*Replaces Guy Fawkes*).—*The Economist.*

When is it going to be made clear that he [the British shipyard manager] is so overworked and harassed by labour troubles that he simply cannot devote the necessary time to study his shipbuilding. . . . All the thanks he gets for this work and in trying to save the overheads of a large staff is this latest criticism of his "inefficiency."—MR. D. C. JEFFREY, technical director, Hugh Smith (Glasgow), Limited, hydraulic engineers, makers of machine tools for shipbuilders, etc.

> *Let us please, then, have an enterprising spirit on the part of the men as well as the management, and let us hope that* 1961 *will see a wind of change blow the unions' clinging Victorian cobwebs right out of the* [*shipbuilding*] *industry's windows.*—DR. DENIS REBBECK, *deputy managing director of Harland & Wolff, Limited.*

Higher Productivity in Cumberland Coalfield

PROGRESS in the plan to turn the Cumberland coalfield into a profit-earning unit is reported in a statement by the general manager of the Cumberland Area of the Northern (N&C) Divisional Coal Board. Mr. J. Lomax, who says that 41 per cent. of Cumberland's coal output is now power-loaded, compared with 17 per cent. a year ago, while productivity has improved by nearly 24 per cent. If these trends continue, Cumberland, which has been losing money, will begin making a profit.

Mr. Lomax says that the future of the industry is in the hands of those intelligent enough, and technically trained, to use more power for the extraction of coal. Those untrained in the use of power were inclined to be frightened of it, but high wages could be earned by those who recognized power as an essential in the modern colliery.

Deadlock Ended over Mining under University Site

CONFLICT between the East Midlands Divisional Coal Board and Nottingham University over the question of mining under the university site, which has gone on for several years, has now been resolved, Sir Francis Hill, president of the University Council, told members of the University Court recently. "After prolonged consultations, the board has made proposals that go so far towards meeting our objections that we can properly accept them."

"We have accordingly told the board that if it makes proposals in this sense to the planning authority, we shall not oppose them," he said.

British Iron and Steel Federation

MR. C. R. WHEELER

1961 PRESIDENT and PRESIDENT-ELECT

SIR JULIAN PODE

MEMBERS of the board of the Steel Company of Wales, Limited, head the British Iron and Steel Federation for the forthcoming year. It was announced last week that Mr. C. R. Wheeler, a director of SCOW, chairman of Guest Keen Iron & Steel, Limited, and additional vice-chairman of Associated Electrical Industries, Limited, would take up his duties as president on Monday and that Sir Julian Pode, managing director of SCOW, is to be appointed president-elect of the federation for 1961.

Mr. Wheeler, who succeeds Mr. R. F. Summers, chairman of John Summers & Sons, Limited, steelmakers, of Shotton (Ches), entered the steel industry on leaving school in 1922, when he joined Baldwins, Limited. After being London manager for the Port Talbot Steel Company, Limited, and other interests of Baldwins, he joined Guest, Keen, Baldwins Iron & Steel Company, Limited, on its formation in 1930, later becoming commercial manager and, in 1940, a director.

During the war he served in the Iron and Steel Control of the Ministry of Supply, at first as assistant controller, raw materials, and later as deputy controller, raw materials. In 1943 he headed the British delegation to the Joint Metallurgical Committee in the US which considered and reported on alloy steel and alloy conservation. He was appointed Controller of Iron and Steel in 1945. For his war-time services he was made CBE in 1946.

Ore-importing Interests

In 1946, Mr. Wheeler returned to Guest, Keen Baldwins (later Guest Keen Iron & Steel Company, Limited) as joint managing director and in 1959 he was appointed chairman of the company.

Recently he was appointed an additional vice-chairman of Associated Electrical Industries, Limited, and is to take up his executive duties in 1962, resigning from the chairmanship of Guest Keen Iron & Steel at the end of this year, although remaining a director of GKN. He joined the board of SCOW earlier this year.

Mr. Wheeler has been a member of the council and the executive committee of the British Iron and Steel Federation since 1926. As chairman of BISC (Ore), Limited, since its formation in 1946, he has been directly concerned with the expansion of the industry's central ore importing arrangements, including the development of the ore carrier fleet and investment in oversea orefields. He has also been chairman of the Federation's international trade relations committee since 1958 and a director of the industry's main central importing agency, BISC, Limited. He has represented the Government on the Steel Committee of the Economic Commission for Europe and the Committee of European Economic Co-operation and was present as an adviser at the Foreign Ministers' Conference in Moscow in 1947. In 1958-59 he was president of the Iron and Steel Institute.

Sir Julian began his career in the steel industry in 1926, when he joined the staff of Guest, Keen & Nettlefolds, Limited, as district accountant at the Dowlais Works. In 1930, when the company's heavy steel interests were amalgamated with those of Baldwins, he was appointed secretary of the new company, Guest Keen Baldwins Iron & Steel. In 1938 he became secretary and joint commercial manager, in 1943 he was appointed assistant managing director, and in 1945 joint managing director. On the formation of SCOW, in 1947, he was appointed managing director.

Sir Julian has been a member of the council and the executive committee of the British Iron and Steel Federation since 1945, is chairman of its Price Policy Committee and serves on a number of other federation committees. He is honorary treasurer of the Iron and Steel Institute, a member of the Industrial Coal Consumers' Council, a director of the National Industrial Fuel Efficiency Service, a member of the grand council of the Federation of British Industries and chairman of its Fuel and Power Consumers' Policy Committee.

He is deputy chairman of the Development Corporation of Wales, a director of GKN, the Steetley Company, Limited, and other companies. He was knighted in the New Year Honours of 1959.

Appointments

Management Changes in N. Staffs NCB

REORGANIZATION of the management of five of the six Groups in the North Staffordshire Area of the West Midlands Divisional Coal Board is to take effect from January 1, 1961. Mr. E. MAWDSLEY has been appointed to the vacant position of manager of the No. 2 Group of collieries.

Mr. F. BALL is transferring from No. 6 Group to take over from Mr. W. T. ARCHER as manager of the No. 3 Group. Mr. Ball is succeeded by Mr. F. DILKS from whom Mr. Archer is taking over as manager of the No. 1 Group.

Mr. P. J. D. HOME and Mr. E. WELDON have joined the Press and publicity department of Crompton Parkinson, Limited.

Mr. STANLEY R. PARKER, senior lecturer at Enfield Technical College (Middx), has been appointed principal of the Engineering Department of Keighley Technical College (Yorks).

So that he can take up a new appointment as production executive with United Gas Industries, Limited, Mr. S. D. CATHCART is resigning from Wallace Attwood Company, Limited, on December 31, 1960.

On the retirement of Mr. A. Friswell, general manager of the steam turbine division of the English Electric Company, Limited, Rugby, on January 1, Mr. L. J. GARIBALDI becomes manager, steam and gas turbines division.

Mr. J. R. ELTRINGHAM, manager of Craghead Colliery (Co. Durham) for five years, has been appointed accident investigator for the Durham Divisional Coal Board. Mr. Eltringham, who started his career as a pony driver, has held other managerial posts at Byermoor, Burnopfield, and Kibblesworth pits.

Mr. ALAN POTTER has been appointed general sales manager of Lansing Bagnall, Limited, material handling equipment manufacturers, of Basingstoke (Hants). Mr. EDGAR HARRY WHEELER has been appointed export sales manager and Mr. CHARLES ARTHUR BARR manager of the company's technical services division.

Present work study officer of United Coke & Chemical Company, Limited, branch of the United Steel Companies, Limited, Mr. J. H. SELLARS, is to become works manager (services) from January 1, 1961. Mr. R. C. Limb, who rejoined the company some months ago as assistant works study officer, becomes works study manager.

Mr. J. D. RIDDLE, formerly manager of the turbine factory at the Rugby works of Associated Electrical Industries, Limited, has been appointed manager of the re-named large machine and compressor department of the company. Mr. R. EVANS, formerly superintendent of large machine production in the heavy plant factory, has been appointed assistant manager of the new department.

Assistant secretary of the Scottish Engineering Employers' Association, Mr. J. MAXWELL TOWERS, has been appointed secretary of the newly-formed West Riding Engineering Employers' Association. He joined the staff of the Clyde Shipbuilders' Association in 1945 and before taking up his present post was industrial relations officer at the Glasgow yard of the Fairfield Shipbuilding & Engineering Company, Limited.

TUC Seeks Talks on Coal with Premier

THE Prime Minister has been asked by the Trades Union Congress to meet representatives of the General Council to discuss Government policy for the coal industry. A letter sent to Mr. Macmillan refers to "the problems of fuel and power and, in particular, the question of the coal-mining industry, in which a serious loss of manpower is being experienced."

The action, announced by Congress House on Wednesday, has been taken at the request of the National Union of Mineworkers. Early this year representatives of the NUM met with the TUC production sub-committee to express their concern at the speedy contraction of the industry planned for 190 and to put forward alternative proposals, including the control of fuel oil imports. The TUC gave general support to the miners' case and representatives met the Minister of Power, Mr. Richard Wood, in March and July. On neither occasion were they satisfied by his explanation of the Government's policy.

The union maintains that Britain will face a coal shortage unless something is done to restore the industry's morale and so stop the drift of labour from the pits. A National Coal Board spokesman said on Wednesday: "There is every sign that we have checked the big drain of manpower from the industry. Our recruiting campaigns are meeting with success, particularly in Scotland. The division which is causing the most concern is South Wales, where there is need for many, many more men."

Police to Investigate Damage at Auchengeich

POLICE have been called in by Mr. James Brown, manager of Auchengeich Colliery (Lanarkshire), to investigate continuing malicious damage of underground fire-fighting equipment. Mr. Brown said the management had "tried everything" through consultative machinery but without success. In a fire at the colliery last year 47 men lost their lives.

Mr. Brown said police interviewed some persons at the pit in connection with the unauthorized discharge of fire-fighting equipment, but the practice was still going on. "Call it malicious damage or sabotage or what you will, we have been unable to stop it," he added.

Some miners have threatened to "take the law into their own hands" if they catch anyone interfering with the fire-fighting equipment.

WEST OFFERS AID FOR INDIAN COAL MINING

FOLLOWING the visit to India last summer of experts from the National Coal Board, the Government has offered technical and other aid for the development of three deep underground coal mines. The US has offered to develop some open-cast mines and West Germany to build and maintain a factory for the production of coal-mining equipment.

The French Government has offered to provide technical field training and 10 Indian engineers are already in France to take advantage of the offer.

Perils of Laissez-Faire

"NO GOING BACK, IF COAL INDUSTRY IS CONTRACTED"

IF the coal industry is forced to contract, through a national fuel policy of *laissez-faire*, and this is followed later by a serious interruption of imported energy supplies, it would be useless in the short-term to return to indigenous coal—it would be too late, warned Mr. H. E. Collins, National Coal Board member for production and reconstruction last week. He added: "We do not expect plain sailing, but we do face the future in the knowledge that we have an industry much improved technically with technical progress still in full spate, and therefore better equipped to meet the challenge of intense competition in our fuel markets."

Mr. Collins, who was addressing the Fuel Luncheon Club in London, said that increased fuel efficiency had been an important factor in the decline in coal consumption—an aspect underestimated in earlier forecasts of energy requirements. But the major factor was undoubtedly oil consumption, which in 1959 amounted, in direct replacement of coal, to 30,000,000 tons of coal equivalent.

"Let me say that I believe fair competition, a useful stimulus to efficiency, to be a good thing provided we do not allow the negative policy of *laissez-faire* to undermine the whole structure of our national economy," he said.

Check Urged on Fuel Oil

Mr. Collins said that much had been said in recent months on the necessity for a national fuel policy. There was unanimity of view as to the principles involved in such a policy, but he suggested that it should ensure, among other things, co-ordination and complete co-operation of the three nationalized fuel industries, and controlled expansion of the oil industry. He did not suggest that co-ordination and co-operation did not exist, but they could be much intensified to make more use of indigenous coal.

He went on to say the most crucial question today concerned the future pattern of primary energy consumption in the UK. In 1946 coal supplied 92 per cent. of all primary energy consumption and oil 7 per cent. The change in the pattern up to 1956 was gradual when the proportion of coal and oil was 82 per cent. and 15 per cent., respectively. In the succeeding years up to 1959 the change was much more adverse to coal. Total energy consumption fell to 246,000,000 tons of coal equivalent and the proportion of coal and oil became 76 per cent. and 23 per cent. respectively.

"Coal output has now been brought generally in line with demand, but with certain qualities we are now concerned with expanding production to meet current and anticipated requirements," he said. "There have been revolutionary changes in the techniques of mining coal and already 40 per cent. of the total output is produced by machines which simultaneously cut the coal at the face and load it on to conveyors. We lead Europe in modern mechanized coalwinning, and further progress is foreshadowed in experimental units of extraction and support now undergoing trials.

"Efficiency, measured in output per manshift worked in 1947, was a little over 21 cwt., whereas today it is almost 29 cwt.—an improvement of 33 per cent. This increase in efficiency has been achieved with considerable improvement in the safety of our mines. Fatal accidents have been reduced by 43 per cent. and serious non-fatal accidents by 31 per cent. There can never be room for complacency in this matter, but progress cannot be regarded as other than satisfactory."

Mr. Collins then said: "Taking a view of the long-term energy demand, we must rely to a large extent on Governmental pronouncements. In the Government's view, formulated in 1957, the upward trend in primary energy consumption is estimated to reach 300,000,000 tons of coal equivalent in 1965. This view has not been changed but has been extended in one field to 1975, when power stations are expected to consume some 125,000,000 tons of coal equivalent, and that by the 1980's their annual requirements could well reach 200,000,000 tons.

"Recently there has been Governmental pressure to increase exports in the interest of our balance of payments. In our highly-industrialized country this is obviously sound. But what of the other side of the coin? Our balance of payments can similarly be influenced by a reduction of unnecessary imports. This applies with much force to our energy requirements. No country with its national economy based on industry can afford to neglect indigenous energy sources. Indeed, there is no intensely industrialized country without such sources, and they could be neglected only at the possible cost of a complete breakdown in industrial production.

"The estimates of forward requirements of energy indicate that there will be scope for substantial increase in the use of oil, while necessitating coal usage in annual quantities sufficient to sustain an economic coal industry.

I suggest that the expansion in the use of imported oil should be so arranged as to represent an appropriate share of the increase in the total inland consumption of primary energy.

"A compact and efficient coal industry in this country requires an annual output in the order of 200,000,000 tons, which in the next five to 10 years would mean about two thirds of total inland primary energy requirements. This leaves about 100,000,000 tons of coal equivalent to other sources, currently running at about 60,000,000 tons, Mr. Collins said.

Obituary

PROF. P. G. H. BOSWELL

THE death has taken place of Prof. Percy George Hamnall Boswell, FRS, who was Professor of Geology at the Imperial College of Science and Technology and head of the Department of Geology, Oil Technology, and Mining Geology from 1930 to 1938. He was 74. Prof. Boswell was educated at Ipswich, the Royal College of Science, and the Royal School of Mines. He was first appointed a demonstrator in geology at the Royal College in 1914 and in 1917 went to Liverpool University as Herdman Professor of Geology.

During the first world war, Prof. Boswell served as scientific adviser in geological matters to the Ministry of Munitions and was called upon to investigate British supplies of moulding sands for use in metal foundries and, as a result, became a recognized authority as a sedimentary petrologist. He worked as a geologist over a very wide field and was much interested in scientific education, serving the British Association as general secretary from 1931 to 1935 and as treasurer from 1935 to 1943. He was president of the Prehistoric Society in 1936 and of the Geological Society of London, 1940-41. He was the author of many books and papers on geological matters.

Controller of Ferrous Metals at the Ministry of Munitions from 1916 to 1919. Mr. BEN WALMSLEY, has died at the age of 89.

Mr. HARRY TOPPS, representative in the North-East and Scotland for the Huddersfield engineering firm of Thomas Broadbent & Sons, Limited, has died at the age of 59.

The death has occurred of Mr. HENRY MATHEWSON, manager of the ship repair yard of R. & H. Green and Silley Weir, Limited, London, E.C.3. He was 58.

The death occurred recently of Mr. HERBERT HOWARD, a director of George Howard, Limited, metal merchants, of Warrington (Lancs). He was 64 and had been associated with the firm for 36 years.

Managing director of Universal Stampings, Limited, Birmingham, Mr. JOHN CHARLES BURROWES has died at the age of 65. He formed the company in 1935, having been an apprentice with the former Wolseley Tool & Motor Company, Limited, Birmingham.

Chairman of Cable & Wireless, Limited and director of a number of companies, including the Dowty Group, Limited, Sir GODFREY HERBERT INCE, died suddenly on Tuesday of last week. From 1941 to 1944 he was director general of manpower under Mr. Ernest Bevin and was chiefly responsible for the organization of the country's labour resources for war-time production and the armed forces.

MR. HORACE WILSON, president of William Hamilton & Company, Limited, the Glasgow shipbuilders, of which he was chairman and managing director until last year, died last week aged 74. Associated with the shipbuilding industry for almost 60 years, he was a former president of the Shipbuilding Employers' Federation and chairman of the Clyde Shipbuilders' Association, a member of the Institution of Naval Architects and of the Institution of Engineers and Shipbuilders in Scotland.

Big Coal Sales Drive in the Spring

THERE will be a "tremendous selling campaign" for coal in the spring, Mr. Alfred Robens, next chairman of the National Coal Board, announced at the close of a two-day tour of the Yorkshire coalfield last week. Asked if there were any likelihood of competition between the coalfields for custom, he said: "I hope, within the individual divisions, there will be greater opportunity for the producing coalfield to follow up its own coal to the customer, and give the proper service to that customer. I am now working out policies by which Divisional Boards will be able to do this."

Speaking at a Press conference at the Doncaster headquarters of the North-Eastern Divisional Board, Mr. Robens said there would, however, be no return to the unfettered competition of pre-war days; he would not see the return of district wages, when pay in the pits varied with the saleability of the type of coal produced in each area. The board would no doubt have to sit down and work out which functions might properly be carried out by the divisions, and which by a central authority. "It is true to say that I am now working out policies which will affect the marketing of coal. We shall, for example, be launching a tremendous selling campaign in the spring."

Mr. Robens said he saw, by determined selling, a market for 200,000,000 tons of coal a year, which is the production the board aims at from the pits by 1965. Production at present was running at 193,500,000 tons, with another 7,000,000 tons being drawn from ground stocks annually. He hoped to absorb any possible wage increase in the industry and to meet the competition of fuel-oil and gas by increased productivity of coal, more mechanization, and an increase in output per manshift. The industry would produce more varieties of smokeless fuel and co-operate with railways in electrification and users of electricity. It would also co-operate closely with the makers of all types of grates and apparatus using solid fuel.

Mr. Robens said that the Yorkshire coalfield had the greatest potential of any in the country, and would be developed rather more than some other coalfields. Mr. W. H. Sales, chairman of the North-Eastern Divisional board, added that the division would for the third year running return a record profit. This would be in spite of Yorkshire's losing 8,635 men during the year. A recruitment drive had arrested the drift from the pits. The year would end with 1,500,000 tons lifted from stocks. Mechanization, concentration on more rewarding seams, and better attendance by miners, had so improved productivity that a considerable increase over last year's record £13,000,000 profit could be expected.

Silver Jubilee of George Kent's Long-service Awards

ANNUAL long-service presentations by George Kent, Limited, industrial instrument and automatic control manufacturers, of Luton, this year marked the 25th anniversary of the inauguration of the scheme.

The recipients' total service amounted to 1,095 years—a record figure—and of the 41 certificates awarded this year, one was for 45 years' service and two for 50 years' service. One of the several board members in attendance, Mr. R. S. Medlock, research and engineering director, received a 25-year certificate.

Auchengeich Colliery

TRIAL OF FORMER MANAGER ENDS

FINE of £100 was imposed at Glasgow Sheriff Court on James Ford Smellie (46), the former manager of Auchengeich Colliery (Lanarkshire), where 47 men died in an underground fire in September, 1959. He was found Guilty of two contraventions of the Mines and Quarries Act, 1954. Sheriff H. S. Wilson found him Not Guilty of two other contraventions of the Act and found three more charges Not Proven.

Smellie was found Guilty and admonished on a charge of failing to appoint competent persons to be in charge, during the night and back shifts, of the machinery driving the booster ventilating fan at the pit, who would examine the machinery and observe the water gauge and automatic indicator at intervals not exceeding half-an-hour.

He was fined £100 for failing to secure the provision and readiness for immediate use in the mine, in case of fire below ground, of adequate supplies of water and efficient means for delivering it promptly at adequate pressure.

Undermanager Not Guilty

Former undermanager of the colliery, Alexander Pettigrew (65), was found not guilty of failing to send about 12 men from the return airway of the pit when there were indications that a fire had broken out underground. Charges made jointly against Smellie and Pettigrew that they failed to have the transmission belt of the fan and the fan itself free from patent defect and properly maintained were found Not Proven. Mr. Pettigrew was discharged.

Referring to the charge of failing to secure the provision and readiness of adequate supplies of water and efficient means for delivering it promptly, Sheriff Wilson said the evidence established, in his opinion, a clear breach of the duties placed on the manager of every mine under the regulations.

Mr. A. Thomson, QC, who defended, described the first charge of which Smellie was found Guilty as a "very technical matter" and said it was difficult to hold the manager morally to blame. Regarding the other charge he claimed that Smellie was "no more than technically responsible." The fire-fighting layout at the pit was not criticized and there was considerable praise for it. The fire hoses in the pit were brought to the surface long ago and it had become an accepted practice that they should stay there.

Mr. Thomson said Smellie had been in the mining industry since he was 14 years old, and in mine management for more than 20 years. He had served as a manager for 16 years in various collieries.

Sheriff Wilson said he regarded the first charge as serious, but in the light of what counsel had said he would take the rather unusual step of making the sentence one of an admonition. On the second charge, however, he could not take the same view.

Mr. Smellie is now manager of Wester Auchengeich Colliery. Mr. Pettigrew retired on September 30 last.

FIRST GIRL to be accepted for a sandwich course by Armstrong Whitworth (Metal Industries), Limited, Miss Rosemary Loe, has qualified as an engineer.

Belgian Coal Output Remains Steady

DESPITE a planned cut-back, Belgium's coal production is running at last year's levels, according to the High Authority of the European Coal and Steel Community. Over the first 45 weeks of the year Belgium produced some 19,390,000 metric tons—exactly as much as in the same period of 1959. Over the same period, coal production in West Germany rose from 121,900,000 tons to 122,500,000 tons and that in France fell from 49,800,000 tons to 48,100,000 tons.

Coal stocks in the ECSC area have fallen by 29,100,000 tons. Within this total French stocks show the first fall this year—to 13,240,000 tons—while German stocks decreased to 8,250,000 tons, and Belgian dumps fell back to 6,740,000 tons. A year ago there were over 32,000,000 tons in stock in the Community area.

Glasshouse Colliery's Farewell Dinner

IF the morale and comradeship in the larger mines were equal to those of Glasshouse Colliery, where the men worked "better together than anywhere in the country," the coal industry would be better off. This was the contention of Mr. F. N. Barrett, acting manager, speaking at the last of the colliery's annual dinners. Glasshouse, a drift mine at Chesterton (Staffs), is worked out and the 50 men who worked there will be transferred to a new mine on the same seam at Apedale when the colliery closes tomorrow (Saturday).

Tributes to the spirit at the mine were also paid by Mr. W. T. Archer, No. 3 Group manager, North Staffordshire Area, of the West Midlands Divisional Coal Board, and Mr. H. Lockett, Area secretary of the National Union of Mineworkers.

THE COMPANY now known as Hawker Siddeley (Hamble), Limited, will trade as Petters, Limited, from January 1, 1961, and will function as the Hamble division of the company at Staines (Middx). Petters of Staines will continue to manufacture and sell diesel engines of 1½ to 108 b.h.p. and the Hamble works to manufacture and sell diesel generators, marine auxiliary sets, etc. Mr. J. C. Dacombe has been appointed to the board of Petters as service manager and Mr. T. D. Turner has also joined the board as general manager, Hamble works.

Board Changes

Hall & Pickles Steelworks Chief Retires

MANAGING director of the Ecclesfield steelworks branch of HALL & PICKLES, LIMITED, steel, tool, and wire makers, of Sheffield, Mr. J. H. Russell, is to retire on January 1, 1961, because of ill health. Mr. Russell, who is also a director of Auto Body Dies, Limited, and the Improved Metal Label Company, Limited, joined the Ecclesfield works in 1931 as forge manager. He will retain his seat on the Ecclesfield board.

He will be succeeded by Mr. F. R. Robbins and Mr. A. M. C. Murphy as joint managing directors. Mr. John L. Lightfoot, who joined the firm in 1918 as an office boy, has been appointed secretary to the company, retaining his directorship. Mr. E. W. B. DAVIS is to become general sales director.

BLAW KNOX, LIMITED—Mr. E. V. Small has joined the board.

FOSECO INTERNATIONAL, LIMITED—Mr. J. A. Metcalfe has joined the board.

METAL TRADERS, LIMITED—Mr. R. H. C. Boys has been appointed a director.

TILLEY LAMP COMPANY, LIMITED—Mr. T. S. Spurling has resigned from the board.

BROOKHURST IGRANIC, LIMITED—Mr. A. W. Page has been appointed sales director.

SHEFFIELD FORGE & ROLLING MILLS COMPANY, LIMITED—Capt. J. K. Hamilton has joined the board.

AMAL, LIMITED—Mr. St. John de Holt Elstub has been elected chairman with effect from January 1 in succession to Mr. J. M. Henderson, who is retiring.

NORTH CENTRAL WAGON & FINANCE COMPANY, LIMITED—Mr. Duncan McIntosh, deputy managing director, has been appointed a joint managing director with effect from January 1.

SHERIDAN MACHINERY COMPANY, LIMITED—Mr. David F. Maltby, a director, has been appointed general manager of the company and of the associate—the Sheridan Service Company, Limited.

S. GUITERMAN & COMPANY, LIMITED—Mr. Julius Trup has been appointed chairman. He has relinquished his seat on the board of B. Elliott & Company, Limited, and its subsidiaries.

LOW MOOR FINE STEELS, LIMITED—Mr. R. Cox, works manager, and Mr. B. P. Yates, director of Low Moor Alloy Steelworks, Limited, and Brayshaw Furnaces, Limited, have been appointed additional directors.

BRITISH GLUES & CHEMICALS, LIMITED—Because of "substantially divergent views on matters of basic policy," Sir Miles Thomas has resigned as deputy chairman. Sir Miles is chairman of Monsanto Chemicals, Limited.

HARPER ENGINEERING & ELECTRONICS, LIMITED—Sir Stanley Rawson has joined the board as chairman in place of Mr. N. C. Weaver, who has relinquished the post but remains on the board. Mr. H. W. Bishop has been made a director.

THOMAS BOLTON & SONS, LIMITED—Mr. L. C. W. Turner is to join the board on January 1 when he will become general manager. Mr. W. F. Slater relinquishes his appointment as general manager tomorrow (Saturday), but will continue as director with special duties.

TRUSCON, LIMITED—Owing to increasing pressure on his time, Sir Halford Reddish is to retire as chairman while still remaining with the company in a consultative capacity. He is to be succeeded by Mr. Robin Brook, one time director of the Bank of England. Mr. P. I. Hayman, secretary, is to join the board. All these changes take effect from January 1.

KAYSER, ELLISON & COMPANY, LIMITED — Mr. L. A. K. Halcomb is retiring at the end of the year as managing director, but continues as chairman. He remains as consultant, and stays on the board of the parent company, Sanderson Kayser, Limited. From January 1, Mr. J. R. A. Bull, chairman and managing director of Sanderson Kayser, and Sanderson Bros. & Newbould, Limited, will also be managing director of Kayser Ellison.

BOUND BROOK BEARINGS, LIMITED—Mr. B. P. R. Parsons, previously managing director, has been appointed chairman and has also joined the board of the parent company, Birfield, Limited. Mr. H. E. Hill, the previous chairman will remain as vice-chairman. Mr. T. L. Martin, formerly administration director, becomes director and joint manager (commercial), and Mr. W. Harris, previously works director, has been appointed director and joint general manager (works).

Darlington & Simpson's Record Output

RECORD output of 183,810 tons was achieved by Darlington & Simpson Rolling Mills, Limited, for the year ended September 30, 1960. This figure represents an increase of 21 per cent. over the previous year. All units of the plant contributed to the increase which has justified the board's policy of modernizing existing plant in the light of current needs.

The future position is viewed with optimism by the chairman, Lord Braintree, in his annual report. The motor trade, together with the National Coal Board, provide the major proportion of the company's business, but as hot and cold rollers of sections for special purposes, new outlets are constantly sought, with the result that the company's products are each year being extended to a wider variety of consuming industries.

Despite meeting increased home market demand, efforts taken to step up oversea sales have resulted in an increase of 63 per cent. over the previous year. Oversea direct sales now represent 10 per cent. of production capacity. A considerable proportion of home market sales are exported after fabrication.

Viscount Weir Resigns from Three Boards

IN order to devote more time to the overall administration of the G. & J. Weir Holdings, Limited, group of companies Viscount Weir is giving up his post on the board of the principal subsidiary, G. & J. Weir, Limited, Glasgow. Mr. J. Russell Lang has been appointed chairman of the company in his place. Lord Weir is also resigning from the boards of Weir-Catton, Limited, and Weir Foundries, Limited.

Mr. J. W. Atwell has been appointed managing director of G. & J. Weir in place of Mr. Lang and Mr. W. K. J. Weir has been appointed an additional director of that company. All the changes take effect from tomorrow (Saturday).

Law Cases

TAX APPEAL FAILS

Colliery Firm's Dividends From Subsidiary

COLLIERY company was liable to pay profits tax on dividends from a wholly-owned subsidiary which received compensation after the nationalization of the mines in 1947, it was ruled in the House of Lords last week. The House dismissed, with costs, an appeal by Henry Briggs Son & Company, Limited, Whitwood Collieries, Normanton (Yorks) (in voluntary liquidation), from lower court judgments that the company was liable for profits tax on dividends received from the subsidiary, Briggs Collieries, Limited (also in liquidation), between 1947 and 1951.

Lord Reid said that Briggs Collieries was formed in 1939 to acquire certain collieries, including those previously owned by the appellant company. It continued to work these collieries until January 1, 1947, the vesting date under the Coal Industry Nationalization Act, 1946.

The decision of the case, he said, depended upon whether Section 19 (4) of the Finance Act, 1937, applied to Briggs Collieries. If it did, the dividends in question were admittedly franked investment income, and ought therefore not to have been included in the computation of the appellant company's profits.

Briggs Collieries, Lord Reid said, had to assemble a great deal of information after the vesting date and had to wait a long time before it received the money due to it, but its whole activities were directed to the realization of its property rights. If it had any functions after the vesting date, those functions consisted in collecting the money due to it and not in the holding of property. He found that the sub-section as a whole was not wide enough in its scope to apply to Briggs Collieries after vesting date.

Judge is Critical of Coal Board Cases

GIVING judgment at Rotherham County Court in a case in which a miner claimed £400 damages from the National Coal Board following an injury at Thurcroft Colliery (Yorks), Judge Ernest Ould said: "I find Coal Board cases the most unsatisfactory class of cases of this nature to try. There always seems to be the most violent conflicts of fact upon the evidence, which makes it very difficult to decide which side is telling the truth—whether it be by way of honest evidence, or dishonest evidence, or inaccurate evidence."

The judge added: "As regards all the witnesses in this case, I did not find any of them very satisfactory for one reason or another."

The miner, Mr. Leonard Cook, said he worked as a point attendant on a coaling shift. After breaking a large piece of coal on the conveyor, he stepped back and tripped over the haulage rope. His elbow was fractured, and it still caused him pain although the accident was in November, 1959.

Mr. Joseph Hill, a deputy at the time, said he measured the height of the rope and found it was only 3 in. above sleeper level. The judge said it "did not matter whether it was 3 in. or 18 in." Awarding £100 damages, he said Mr. Cook was three quarters responsible for the accident through his own carelessness. He did not find that there had been negligence on the part of the Coal Board, but there was a breach of statutory duty.

MINER'S £400 CLAIM FAILS

AN accident at Thurcroft Colliery (Yorks), in which a cutter man trapped his fingers in a machine, was "one in a million," said Judge Ernest Ould at Rotherham County Court. He dismissed a claim for £400 damages against the National Coal Board by Mr. Reginald Alders. It was stated that Alders' coal-cutting machine had broken down and he had sent for a fitter, Mr. John Standerline. Alders alleged that the fitter started up the machine while he had his hand inside it.

Mr. Standerline said he would be expecting the cutter man to help generally while he did the repairs. "As I switched the machine on Mr. Alders shouted his fingers were trapped. When I switched on his hand was not inside the machine. As I switched on he reached across me."

The judge said he was satisfied that Mr. Standerline would not have switched on if he had seen the plaintiff's hand in the machine. "This is the case of an accident in a million. At the very moment Mr. Standerline decided to switch on, the plaintiff, without any warning—perhaps thinking he was doing the best thing—put his hand into the machine. It was all done in the fraction of a second." Alders, he said, had not satisfied him that Mr. Standerline was negligent.

CIGARETTES: TWO MINERS FINED

FINES totalling £13 were imposed by Blackwood Magistrates Court on two underground workers for having cigarettes in their possession when about to go below ground at Pengam Colliery (Mon). Harold Raymond Smith was fined £3 and Graham David Jones £10. Both pleaded Guilty.

Col. K. D. Treasure, prosecuting, said Smith was searched at the colliery before going underground to start work. He was asked to open his food box, and the searcher found some cigarettes wrapped up beside food. Jones was found to have a cigarette lighter as well as cigarettes wrapped up with his food and drink.

It was stated that both men had been dismissed from their employment.

Scottish Farewell to Deputy Coal Chief

MR. JAMES ANDERTON, deputy chairman of the Scottish Divisional Coal Board, who takes farewell this week of his Scottish colleagues and friends before moving to Manchester to take charge as chairman of the North - Western Division, will be greatly missed here, *writes a Scottish mining correspondent.*

MR. JAMES ANDERTON

In the comparatively short time—just over two years—that Mr. Anderton has spent in the Scottish Division, he has gained the confidence and esteem of all levels from pit to board room. Since his appointment as deputy chairman in September, 1958, with special responsibilities on the mining side, he has made a fine personal contribution to the Scottish Board's vigorous drive for higher productivity, as reflected in the very substantial improvement effected during the past two years in the OMS figures of the Scottish Division.

Within a matter of another 12 months, writes our correspondent, some 50 per cent. of Scotland's total output should be coming from power-loaded techniques, or nearly three times the figure of three years ago, and Mr. Anderton's own machine, the Anderton shearer loader, has played a conspicuous part in these operations. Men and management join warmly in wishing him every success in his new post—coal chief in his own native county.

"Development not Retrenchment" for South Wales Coalfield

IN a seasonal message with a cheerful theme, Mr. David M. Rees, chairman of the South-Western Divisional Coal Board, told 85,000 miners that productivity in the South Wales coalfield is the highest ever and the challenge of the future is development, not retrenchment. On the shortage of miners in the division, Mr. Rees says, "more men and boys are urgently needed and employment is secure and permanent. Development and recruitment are essential in the division and these objectives should always be foremost in our minds."

He continued, "I cannot declare too strongly my belief in the future of the industry, particularly of the South Wales coalfield, which has such extensive reserves of the best qualities and the most-needed types of coal."

GROWING NEED for men able to fill executive positions is shown by the fact that when seven ex-officers attending a six-week reorientation course at Sheffield Technical College applied for employment in the area, all were offered posts.

Orders Placed

£1,500,000 Contract for Arc Furnaces

CONTRACT worth £1,500,000 has been secured by G.W.B. Furnaces, Limited, Dudley (Worcs), to build four electric arc melting furnaces as part of the £10,000,000 development programme of the Steel, Peech & Tozer branch of the United Steel Companies, Limited. The four furnaces will be of Demag swing roof design. Steel construction will be carried out by the Distington Engineering Company, Limited, another branch of United Steel.

With an internal diameter of 24 ft. and a nominal capacity of 150 tons, each furnace will be capable of melting at the rate of 1 ton a minute. Total output of the finished plant will be 1,135,000 ingot tons of steel a year. G.W.B. Furnaces has already built two similar furnaces for the firm.

SOME 165,580 yds. of 132 kV single core oil-filled cable and 55,000 yds. of auxiliary cable for installation in London have been ordered from Pirelli-General Cable Works, Limited, by the Central Electricity Generating Board. The contract is worth about £1,250,000.

DIESEL GENERATING PLANT worth £150,000 is to be supplied by Hampson Industries, Limited, West Bromwich, for development schemes being carried out by the Radio Corporation of America for the US Government. Another order, worth £25,000, for generating plant for United Nations troops in the Congo and the Gaza Strip has also been secured by the company.

SET OF pinch-pyramid plate bending rolls to deal with steel plates up to 12 ft. wide and 3¼ in. thick have been ordered from the Bronx Engineering Company, Limited, Stourbridge (Worcs), by the J. B. Beaird Company, of Louisiana, US. The American company is the largest manufacturer of high-pressure vessels in the world and the £50,000 order is thought to be the first of its type placed in the UK by an American company.

AN ORDER has been received by Cable Belt, Limited, Inverness, from No. 6 Area, East Midlands Divisional Coal Board, for a single-stage conveyor which will be 13,800 ft. in length. Preliminary work on the installation of the conveyor, believed to be the longest single-stage belt conveyor in the world, has begun and erection will take place during the colliery annual holidays in August. It will be underground in its entirety. The company has a rope-driven conveyor installation operating in Australia which is 12,700 ft. in length.

BECAUSE OF Sheffield redevelopment plans, the Tenuous Steel Company, Limited, a member of the Firth Cleveland, Limited, group is to move from the city and share premises with another member of the group, J. J. Habershon & Sons, Limited, Rotherham.

NEW COMPANY—Firth Cleveland Steel Incorporated—with offices at 230, Park Avenue, New York, has been formed by the Firth Cleveland, Limited, group, to act as selling agent in the US for all the companies in the steels division of the group—Firth Cleveland Steel, Limited, Richard Hill, Limited, Richard Hill Rolling Mills, Limited, the Firth Company, Limited, the Sheffield Wire Rope Company, Limited, and Keeton Sons & Company, Limited.

Hydraulics in Mining

APPLICATIONS ON A COAL-PLOUGH FACE

Use of hydraulic equipment in mining operations is described in this paper, which was presented to the North of England Branch of the National Association of Colliery Managers on January 16, 1960. Particular reference is made to the application of hydraulics to a coal-plough face where an increased advance was required in order to maintain the same output from a smaller face. All face equipment was hydraulically operated, and of particular interest are the trials carried out with portable stable conveyors.

*by K. Kay**

THE Mining Machinery Exhibition in London in July, 1959, gave mining engineers an excellent opportunity of studying the influence that hydraulics now have on mining equipment. No single paper could give such immense detail of the rapid improvements that have been made in recent years in mechanization and transport systems.

It is, therefore, proposed in this paper to deal briefly with improvements up to the coal face and give details of experiences with hydraulic equipment on a power-loading unit where Desford chocks, Bonser Tristram rams, and experimental hydraulic stall conveyors have been used with an Anbauhobel plough installation.

With the increase in the use of large-capacity mine cars, control equipment has been designed to minimize the use of manpower both at the surface and underground. Where large outputs are controlled by hydraulic handling plant, the decking rams on the surface eject the full car from the cage while picking up the empty. The system also usually includes hydraulically operated keps, shaft gates, and car stops.

The cars are then moved by a traverser or creeper/ram to the tippler. This can be fully automatic with a manually controlled system in case of emergency. Tippler drive mechanisms can incorporate variable speed hydraulic motors with automatic braking. The control of this equipment can be operated from a central point by a single person in charge of the push buttons which operate the equipment.

In skipwinding, hydraulics are now used to control the guillotine skip doors, and on some plants hydraulic motors with variable speeds feed the coal at the required rate into the surge or bunker conveyor. Self-contained power units of size and capacity related to the work to be done are connected to this equipment. Mineral oil is normally used as the hydraulic medium, with a tank to hold sufficient fluid to keep the system cool. The horsepower of the motors is usually quite small in relation to the work done and pressures vary considerably. Power is transmitted from the pump to the equipment in solid-drawn steel tubes and, with planned maintenance, give a high standard of efficiency.

* Manager, Fishburn Colliery, Durham Divisional Coal Board.

Transport Systems

Improvements have also been made at loading points, a typical exampie being the Dowty equipment where a single power pack is used in conjunction with two sets of rams.

The rams have a 55-in. stroke and work with a thrust of 2,200 lb. They are set between the track, minimum excavation being required. The whole unit can be quickly withdrawn and a replacement set in the same position. All operations of loading and marshalling are controlled from one point by handles on the valves.

Guillotine doors can also be used and operated by a small hydraulic ram on the hopper doors in the same power circuit.

In some cases anti-spillage conveyors are operated by similar means.

One of the best known applications is the fluid coupling for conveyor drives. These couplings facilitate light-load starting and give limited stalling torque and a smooth drive. Each coupling, which connects the motor to the gearbox, contains mineral oil.

The couplings are fitted with a fusible plug through which the oil can escape if its temperature becomes excessive.

The fusible plugs can be used for different temperatures, but in the interests of standardization the underground face equipment standard of between 200 deg. F. and 266 deg. F. is generally adopted.

Coal-face Equipment

In bord-and-pillar workings hydraulics have been used effectively to perform some of the complicated

operations on Joy loaders and, later, the Joy continuous miner.

By the introduction of hydraulics to some of the longwall power-loading machines, attempts are now being made to confine the driving power to the gates to make working conditions safer in the vicinity of a high horsepower machine at the face. In the case of the Huwood slicer, it is proposed to improve control of the chain drive, but there are still problems to overcome in this field to obtain the necessary efficiency. Investigations are also being made into the possibility of using hydraulic transmission with plough installations to reduce the size of drive units and simplify the support system at roadheads.

Self-contained hydraulic systems are now being used with high-powered machines. This applies particularly to trepanners, Anderton shearers, the Samson stripper, and M & C loaders for part of the normal operations and, with cutting machines, the B J-D Magnamatic transmission is an example of recent developments.

The Huwood ML6 loader is also a typical example of how rope haulage can be replaced by the addition of a small hydraulic pump on the machine. Two retractable jack posts and two control rams form the equipment, which gives the machine greater flexibility of movement with a small horsepower motor.

Mineral oil is mainly used in these systems to ensure good lubrication, the main object being to obtain a smooth and variable movement which can readily be controlled and limited by safety valves in the system.

Hydraulic roof supports are now well known and completely mechanized hydraulic support systems are now manufactured in several forms.

Auxiliary Equipment

Tunnelling efficiency has received much attention in recent years and several forms of hydraulic controls are being used with equipment in new drivages. Associated with supports, strap and girder straighteners are now hydraulically operated and the Korfmann arch saver has provided a useful machine to assist in the speed up of salvage.

In addition to all this equipment, jacks, flight bar straighteners, wire rope and cable cutters, and tub straightening kits are now included in hydraulic form. With Flexiforce equipment, hand-operated hydraulic rams, coupled to accessories with hydraulic hose, can be used for lifting arches at a safe distance, and can also be used for pipe and rail bending.

In the majority of these systems the fluid used is mineral oil or synthetic fluid, as water alone lacks lubricating properties and causes corrosion.

Application of Hydraulics to a Plough Installation

During 1958, a Lobbehobel plough had been worked at a Durham colliery giving an overall o.m.s. of 179.6 cwt. using pneumatic rams. The seam section averaged 4 ft. 4 in. with a face length of 200 yd. The roof consisted of massive

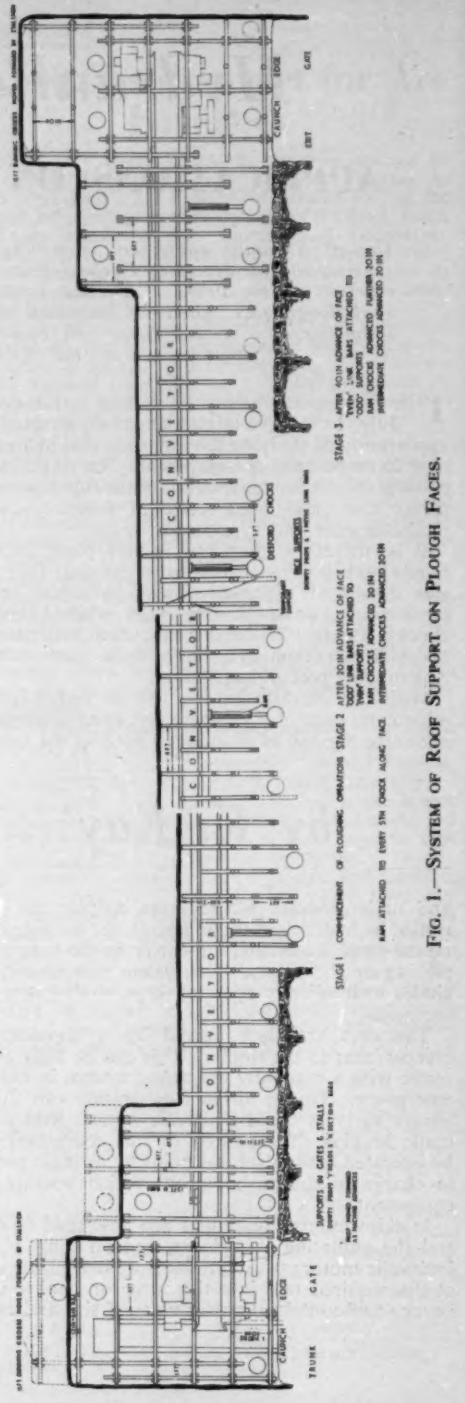

STAGE 1 COMMENCEMENT OF PLOUGHING OPERATIONS
STAGE 2 AFTER 20 IN ADVANCE OF FACE
STAGE 3 AFTER 10 IN ADVANCE OF FACE
CONVEYOR
GATE EDGE
CRUNCH EDGE
DEEPORD CHOCKS
SUPPORTS IN GATES & STALLS

FIG. 1.—SYSTEM OF ROOF SUPPORT ON PLOUGH FACES.

hard sandstone with varying thickness of ramble and the floor laminated sandstone. The working depth was 750 ft. with a gradient of 1 in 6 in favour of the load and also a rise of 1 in 6 in the line of advance with the cleat at an angle of approximately 30 deg. to the face.

Later, a replacement face was to work parallel to this unit under similar conditions, but, due to the presence of a major fault, the length was reduced to 160 yd. In order to improve the rate of advance and maintain the previous output from the smaller face, it was decided to introduce hydraulic rams and chocks and try out stall conveyors so that the manpower could be reduced.

Fig. 1 indicates the system of support, Groetschel link bars, type K56, were supported by Dowty props fitted with prong tops and Desford chocks were set at 5-ft. intervals. Every fourth chock was coupled direct to a ram to facilitate its advance. The roadheads and stalls were supported by a slide-bar system and reinforced with chocks. An Anbauhobel plough, to give a 2¼-in. cut, was to be used with a PF1 armoured conveyor.

Conveyor Rams

The tube of the Bonser Tristram ram, chosen for the installation, has an inside diameter of 3 in. giving a piston area of 7 sq. in.; the diameter of the piston rod is 2 in. The total length of the ram is 74¼ in. when extended and 44¼ in. closed, giving a maximum stroke of 30 in. The width is 4½ in. over the major length, with 10 in. at the connecting nipple guard, and weighs 111 lb.

The ram can be fitted with a cradle and stell prop or coupled direct to Desford chocks by a small bracket (Fig. 2). With 1,000 lb./sq. in. pressure from the pump, a thrust of 3.15 tons and a return pull of 2.20 tons is obtained. The range of pressures for ploughing vary from 200-500 lb./sq. in. depending on the nature of the coal, seam gradient, etc. Twenty-six rams were required for the face with two in the vicinity of the drives to assist in racking over the drive units.

Power Pump and Couplings

An Evans three-ram pump, type 853 W/M, supplies the necessary pressure with approximately 200 strokes/min. The diameter of the rams are 1 in. with a 4-in. stroke. The maximum pressure is 1,500 lb./sq. in. and the capacity approximately 6 gal./min. with a motor of 10 h.p.

The coupling hoses are rubber-covered single-wire braided and tested to withstand a pressure of 2,000 lb./sq. in. The delivery side is of ¼-in. bore and the return or exhaust side is ½-in. bore. Hoses are supplied in 20-ft. lengths, which is the normal distance between every fourth pan on the armoured conveyor. The rams are coupled from T-pieces, which may incorporate a valve to isolate the ram if required. Similar couplings are used to the pump in the gate from the first ram for purpose of standardization, but longer lengths are supplied if required. A high-pressure filter is fitted on the delivery side of the pump to exclude foreign bodies from the system.

Two reserve tanks containing a total of 100 gal. of the water/soluble oil mixture are coupled to the pump by a short hose. The soluble oil is added to form 3 per cent. of the mixture. Suitable strainers are also located in the tank.

Water supply is normally obtained from the fire range, but in this particular case, as approximately 500 gal./min. is pumped from the district, water was taken from one of the roof feeders.

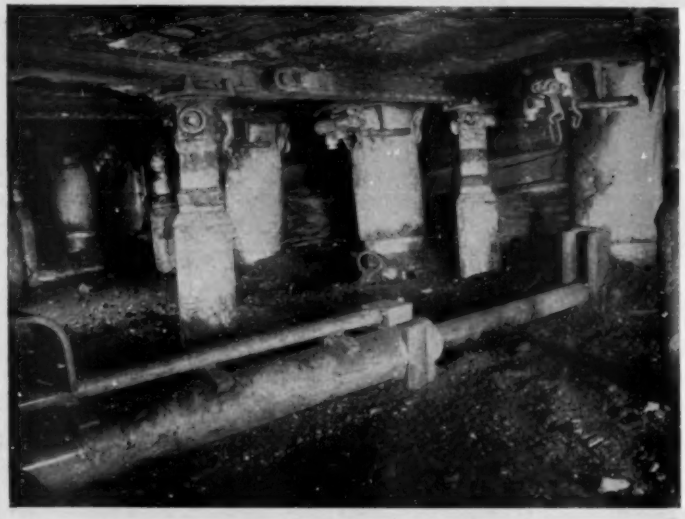


FIG. 2.—DESFORD CHOCKS COUPLED TO THE RAMS.

Hydraulic Chocks

The Desford chocks are manufactured in various sizes to suit the seam thickness and basically are 1 ft. 6 in. to 4 ft. high, but by the addition of 6-in. or 12-in. steel pedestals, they can be built up to 7 ft. high.

The chocks were developed by A. G. Wild & Company, Limited, at the request of the East Midlands Division in 1953. The idea had been tried out in No. 7 Area, East Midlands Division, with prototype chocks made in its own workshops, and working off the rising main. The main object was to pre-load the roof depending on the water pressure available. It was found that the pre-load was 4½ ton/100 lb./sq. in. water pressure on the 100-ton chock and half this amount on the 50-ton chock. The original chock had a seal of V-belting

and a relief valve made from a spring-loaded ball on a metal seat.

Since this time the Desford chock has been developed to its present form and is now considered to be a most reliable and efficient hydraulic chock. It is a strong single unit capable of withstanding the full load up to yield point of 50 or 100 tons, according to type, on any part in contact with the roof, this being the advantage of using a single-cylinder and ram.

The chock mainly consists of a piston and cylinder, the latter being 11½-in. bore on the 100-ton chock and 8 in. on the 50-ton chock. The cylinders are made of high-quality, cold-drawn steel tube, having an adequate safety factor for the maximum working pressure at relief point of 2,150 lb./sq. in., which is a very low working pressure for the load carried and is less than half the normal working pressure of other types of hydraulic supports.

The chock has a large top and bottom plate fixed rigidly to the cylinder and piston giving roof and floor contact in the region of 350 sq. in. each on the 100-ton chock and 175 sq. in. for the 50-ton chock.

The chock consists of four working parts—the cylinder, piston, main seal, and a quick detachable valve. The valve on the Desford chock is standard to both sizes of chock and is interchangeable. In the main, the valve consists of special alloy construction which is incorrodible and attaches to the chock with two ½-in. bolts to enable it to be detached quickly for maintenance. Inside the valve are two spring-loaded seals, one acting as a non-return on the filling side and the other set to relieve at the yield point of the chock. The relief valve can also be operated by remote control or manually to lower the chock. Four escape holes are located on the chock so that the fluid can flow if the chock is fully extended before reaching the roof.

Hydraulic Portable Stall Conveyors

In order to facilitate work in the stalls and reduce the manpower previously required it was decided to try out two small hydraulically operated conveyors (Fig. 3) in the tail-gate stall.

The Central Engineering Establishment of the NCB at Bretby was ready to conduct field trials on this type of conveyor fitted with a hydraulic drive and permission was given to install them on this unit.

Main details of the conveyor are as follow:—Overall length, 8 ft.; height, 10 in.; belt width, 18 in.; belt type, single ply, nylon weft, p.v.c.; drive roller, 5½ in. dia.; ½-in. crown; tension roller, squirrel-cage type, 5½ in. dia.; idler rollers, 18½ in. long by 1.9 in. dia., p.v.c. roller with nylon bushes; drive motor, Lockheed, model 350; belt speed, 125 ft./min.; motor speed, 87 r.p.m.; motor h.p., 0.5 h.p. at 1,000 lb./sq. in., 87 r.p.m.; weight of conveyor, 230 lb.

In order that trials could be kept independent of the production equipment a separate power pack was used. This consisted of a Dowty Vardell pump with a 5-h.p. motor and had a capacity of 2½ gal./min. at 2,000 lb./sq. in.

The unit commenced full production in May, 1959. Only the hydraulic rams were available at this time and the remainder of the equipment was installed while production was being maintained.

In each case, engineers from the firms concerned assisted the mine mechanics with the installation. By this means the mechanics were able to become familiar with the new equipment and gain knowledge on maintenance.

The brackets coupling the rams to the chocks were adapted to suit the gradient to maintain the conveyor on the floor level.

Operational Results

It was soon found that the hydraulically operated rams gave greater flexibility in dealing with hard coal. The pressure on the rams could be varied to suit the hardness of the coal and it was found that in some parts 200 lb./sq. in. was adequate, while in others, particularly near physical abnormalities, up to 500 lb./sq. in. was required.

Normally, the pressure does not need altering during the shift, but this can be done when necessary to keep the face straight and no difficulty has been experienced in maintaining the planned rate of advance.

Apart from two bent pistons of the rams, caused

FIG. 3.—EXPERIMENTAL HYDRAULICALLY DRIVEN STALL CONVEYOR.

partially by the movement of the conveyor and replacement of several damaged hoses, there have been no difficulties and maintenance has been simple.

With the introduction of the hydraulic chocks, especially the ones coupled to the conveyor by the rams, systematic and regular advance was assured. The rigid breaking-off line produced good caving and full control of the roof.

Time saved was a very important factor and with the simple arrangements for tripping and resetting, the whole operation of withdrawing the chocks could be carried out in as little as 20 sec. when coupled to a ram. This means greater safety for the men drawing off and gives a feeling of security on the face.

Care has to be taken when pulling forward the chocks to avoid the top falling back. This did occur in one case and the chock was partially buried. During the recovery the top cylinder was pulled completely from the bottom and the chock was sent to the surface for cleaning and refitting.

In odd cases, valves have been replaced due to the presence of dirt in the " wanderlead " connections and operators have now been trained to leave these on the chocks when not in use.

The stall conveyors have proved to be a very successful addition to the stall by saving casting over the drive units and assist in the reduction of manpower at these points. Difficulties were experienced in fitting the two conveyors between the numerous supports and with the continual movement of the drive unit while racking in.

With a single conveyor, manœuvring was simplified and it has stood up to the rigours of pulsed-infusion shotfiring without difficulty. When tried out with the Desford chock power unit it was found that as the chocks were being moved forward there was a tendency to stall the small unit due to the small capacity of the pump. The second conveyor was used by the stonemen and again assisted in casting, especially when against the gradient.

The system has meant an increase in the equipment positioned in the gates and attempts are now being made to have one power pack of adequate capacity for all three operations. Pressure relief valves can be fitted to the rams to obtain the difference required.

TABLE 1.—*The Results Obtained with the Hydraulic Equipment.*

Month.	Days worked.	Output, tons.	Advance, yd.	Overall o.m.s., cwt.
May	19	5,884	26	174.9
June ..	25	9,059	40	221.5
July ..	20	7,977	35¼	240.6
August ..	10	3,678	16¼	219.0
September ..	25	9,089	41¼	217.7
October ..	20	8,015	36¼	239.9
November ..	20	7,801	34¼	235.9

Output has been affected by ramble, which varies in thickness up to 2 ft., and water from the roof, which affects the working of the conveyor, but throughout the period the hydraulic equipment has stood up well to the conditions.

Attendants are no longer required for the compressor as the plough operator looks after the power pack near the face. Labour is also saved on the extension and maintenance of pipe ranges as the pump is moved forward frequently with the other electrical switchgear.

Power consumption is also reduced when comparisons are made with the different sizes of motors used and there is a general improvement on the previous system.

From the experience gained on this unit another face with identical equipment is being tried out in a seam section of 1 ft. 10 in. to 2 ft. 6 in. high; production started at the end of 1959. The advancement of the stalls in such conditions present a major problem as additional height, for a distance of 5 yd., must be made for the drive units and their supports. The portable conveyors were transferred to continue trials in low conditions. On one conveyor, the small motor was speeded up to attempt to throw the coal between the plough chains near the end of the run of the plough to avoid making extra height for this operation. The belt speed was increased by over 50 per cent. and it will be interesting to know how long the motor will last in such exacting conditions. Movement of the stone is also carried out by the same conveyor in the caunching shift.

The reduced height of the rams makes a considerable difference for the men moving the supports forward in this seam section, and where the chocks are directly coupled to them advancement is speedily carried out.

Conclusions

Hydraulics are providing safer and more attractive working conditions by giving better control of the equipment and the roof. There is still much work to be done in this field, as efficiency is lost in the transfer of power through a hydraulic transmission, especially where high horsepower is required. High-pressure hoses can now be used; as an example, with the Armstrong Airbreaker, pressures of up to approximately 9,000 lb./sq. in. are transmitted along coal faces with flexible hoses and these may assist in dealing with such problems.

Different types of new equipment are frequently being reported as being available for trial, such as drills and fans, and even lighting sets, which can be operated from water mains, indicating that hydraulics are entering all fields of mining operations.

It has always been the hope of mining engineers to make use of the water often encountered in mines and rapid progress is now being made in that direction.

The initial high cost of these new installations, particularly the self-advancing roof supports, can soon be offset by the reduced cost per ton of the coal produced by these methods. By the use of hydraulics a higher standard of efficiency can be obtained and, by such improvements, double-shift working can be introduced and allow concentration of outputs without loss of maintenance.

New equipment operated by hydraulics is being tried out on a very large scale, and although they will not always replace some of the present methods, there is no doubt that they will continue to be an important factor in the mining of coal.

The author thanks the Area general manager, No. 4 Area, Durham Division, for permission to read this paper and the manufacturers who have provided the information. The views expressed are the author's and not necessarily those of the National Coal Board.

DISCUSSION

MR. T. HALL, opening the discussion, asked the author what height he considered suitable for the stable holes. The AUTHOR replied that the type of support necessary for ploughs required 5 yd. width and a height of 4 ft. for moving and racking in the conveyor.

MR. L. ATKINSON, who asked for the length of the face and what was actually included in the quoted overall o.m.s., was told that the overall o.m.s. included everyone on the face, including the conveyor operators and the men who extend the conveyor up to the face. The average length of the face was 160 yd. and the height 4 ft. 4 in.

MR. M. RIDDELL commented that in using hydraulics on the plough unit there would be a problem of drilling the caunch caused by the removal of the compressed air. He asked if drilling legs, operated by hydraulics, had been tried.

Replying, the AUTHOR said that an electrically powered feed drill was being used, but they were thinking of using the Sutcliffe hydraulic drill. This operation did not hold up the advance of the face.

MR. W. A. SUMMERS said that the author had had experience on a single face with two different chocking systems, the Crompton Harrison and Desford hydraulic. He asked if there was any change in roof conditions or any decrease in convergence. What was the effect due to the chocks on the manpower required for support setting? Mr. Summers also asked for further details on obtaining three separate pressures from one pump simultaneously.

The AUTHOR said that the pump was only designed for two pressures, one for the rams, and the other for the Desford chocks and conveyor. It was necessary to get a pump of adequate capacity to provide sufficient pressure, and to have a pressure-relief valve fitted near to the pump or fitted on to the rams. The pressure was changed at the pump itself. There was an increased advance and the manpower was reduced by four from the previous face. There were 14 on the previous face and 10 on the new face, two men being employed to deal with the 2 ft. of ramble. There were no actual measurements of convergence on the new face, but no face breaks, which had occurred on the previous unit, had been experienced.

MR. J. KUTI said he did not agree with the wholesale application of hydraulics for cage loading and unloading. In taking the amount of compressed air needed as 180 cub. ft./min. for a complete decking installation, absolute simplicity of proving controls was obtained. The proving gear was far simpler for compressed-air operation, less costly, and much easier to maintain. The use of compressed air, however, in pit-bottom marshalling operations was expensive, and hydraulics should be introduced. Hydraulic propulsion at a loading point was less costly in actual power consumption, but if the thrust remained at the same level, as with compressed-air equipment, there was no gain. An electrical hydraulic propelling unit should have a much higher tractive force. One of the main advantages of introducing hydraulic rams to ploughing had been the ease of varying the applied pressures. Local disturbances, small falls, etc., could be easily countered if the pressure was capable of variation. There was much to be said for having two separate hydraulic lines and power pumps.

In reply, the AUTHOR, referring to shaft equipment, said that the point about compressed air was the danger of freezing up in winter weather, but eventually a combination of both compressed air and hydraulics might be developed. Compressed air had certain advantages in certain operations. At loading points the Dowty rams were used instead of mechanical creeper chains where compressed air was not available; hydraulic pumps would be much more efficient and easier to install and maintain. The Dowty ram was coupled to the sleepers, and could be changed if necessary. With a single pump for the supply of hydraulic pressure the main object was to try to reduce equipment. Pumps were required for pulsed infusion and for rams. There was a lot of equipment required and it was difficult to handle. Flexibility might be lost by installing a single pump, but separate lines could allow the plough to be used on a different pressure during another shift.

MR. J. MAUGHAN asked if the author had any experience with Desford chocks in soft floor conditions. The AUTHOR had intimated that the use of flexible hose at high pressures with the Armstrong Airbreaker made it possible to consider increasing oil pressures. His experience with the Airbreaker had indicated that the flexible hose was still not satisfactory for pressures of this kind. The paper described the roof as a hard rock and Mr. Maughan asked if the withdrawal of the compressor had given rise to problems with drilling the ripping lips.

In reply, the AUTHOR said a face was being worked with Desford chocks in the Harvey Seam, where, due to water, the floor was very soft. Roof control in such conditions had proved extremely difficult and at times all supports were pushed into the floor. They had not tried a plough with a soft floor yet, but hoped to do so in the near future. With regard to flexible hoses, they used an Armstrong Airbreaker for some time and there was only one breakage due to a faulty connection.

Replying to MR. J. B. NICHOLSON, the AUTHOR said the Brockwell was a very difficult seam to work. There were swillies on the face and post intrusions in the roof. In swillies there was a tendency to get a crop coal on the face and care was needed to prevent the plough climbing into the roof. The actual equipment worked very well.

MR. E. CHARLTON remarked that an o.m.s. of 12 tons has been obtained from a seam of 4 ft. 4 in. thick and asked what o.m.s. was expected in a seam thickness of 1 ft. 10 in. to 2 ft. 6 in. The AUTHOR replied that to get a similar o.m.s. it would be necessary to have an advance of 10 ft. to 11 ft. in a shift, and with the difficulties of caunch work extra men were needed. It was very difficult to obtain such a high o.m.s. from a low seam.

Replying to MR. F. FORD, who asked what was the present o.m.s. in a seam thickness of 1 ft. 10 in. to 2 ft. 6 in., the AUTHOR said that 6 tons per man was being produced.

MR. J. T. HARDING said it had been mentioned that pit water had been used with the hydraulic chocks and he asked if it had any adverse effect upon the operation

(Contd. on facing page)

IMPROVED ENVIRONMENTAL *Sampling in Mines*

MINE atmospheres must be sampled for methane and dust concentrations to ensure safe working conditions. Existing instruments sample instantaneously or over short periods and only provide information at the time of the test. To give improved protection the National Coal Board's Mining Research Establishment at Isleworth (Middx) has developed instruments which operate continuously.

For gas, warning is required whenever the concentration approaches an explosive value even for a moment. The danger from dust is represented not by momentary peak concentrations, but by the total amount breathed; the instrument should therefore collect a sample continuously over the whole shift.

To improve the continuous recording of gas a butane flame methanometer (Fig. 1) has been designed. This instrument uses a small flame burning in a gauze-protected enclosure as in the Davy lamp. Instead of observing the "cap" above the flame, thermocouples are used to show the increased temperature when gas is present in the air; the electrical output of the thermocouples operates an indicating meter or recorder.

FIG. 1.—RECORDING BUTANE FLAME METHANOMETER DESIGNED BY THE NCB'S MINING RESEARCH ESTABLISHMENT.

Accuracy depends on constancy of the flame, which is achieved by using butane fuel controlled by a precision regulator. The model now going into production runs for eight days without refuelling and is accurate to about 0.05 per cent. methane; smaller and more portable versions will follow.

A long-running thermal precipitator has been designed to measure respirable dust over an 8-hr. shift, giving a single sample for evaluation. A size selector excludes the larger particles which would be trapped in the upper respiratory passages of an underground worker, thus leaving in the sample only the dust which would reach the lungs. The collected dust is normally assessed by counting the particles, which is lengthy and tedious, although with the present instrument there are fewer samples to evaluate. A photoelectric densitometer for counting particles is being developed.

The "Bestwood" Jackpot

THE "Bestwood" Jackpot, which enables two complete steel arches to be set within 40 to 60 min. from the time of firing without having to clean up all the dirt, has been designed by Mr. J. E. Hardstaff, a ripper at Bestwood Colliery (Notts).

Jackpots have been used in the NCB's East Midlands Division for some time, but Mr. Hardstaff's design has the virtue of being more easily assembled and dismantled. The jackpots consist of a set of four pressed-steel boxes with detachable backplates and lids. When in use the backplates are held in position by slots attached to the other parts of the boxes and by the overhanging edges of the lids. After clearing the debris from the tops of the jackpots, the lids are removed and the legs of the arches are set inside immediately. The backplates are held only in the bottom of the jackpots after the removal of the lids, and the backplates are thus easily lifted out.

The remaining three-sided parts of the jackpots can be extricated from the surrounding debris without effort by lifting, enabling dirt to be thrown into the pack without hindrance.

HYDRAULICS IN MINING

(Contd. from previous page)

of the hydraulic valves. With regard to the use of Desford chocks coupled with rams for ploughing, it was not quite clear how the support system worked. The rams would extend 2 ft. 6 in. with metre bars. Were the chocks moved forward more frequently than the bars?

Replying, the AUTHOR said that the pit water was influenced by the overlying limestone strata with a total hardness of 348 parts per thousand. When used cold it was quite suitable. With regard to the system of support, the metre bars were in a "saw tooth" position. One bar was taken off and the chocks moved forward 20 in.: alternate bars were moved forward 40 in

Seasonal Greetings

IN conveying our thanks for the calendars and diaries mentioned below, we take the opportunity of expressing our best wishes for the New Year to the senders.

MONO PUMPS, LIMITED, London, E.C.1—Several pages of information concerning the Mono pump are included in the company's diary.

CROFTS (ENGINEERS), LIMITED, Bradford—Various examples of the equipment produced by the company are used to illustrate a monthly wall calendar.

STANTON IRONWORKS COMPANY, LIMITED, near Nottingham—A list of some of the principal sport fixtures in 1961 is a feature of the Stanton diary, which also contains other information not common to all diaries.

BRITISH NYLON SPINNERS, LIMITED, London, S.W.1—A sturdy and serviceable desk diary contains interesting and useful information concerning the company's products, much of it being put over in photographs, some of which will certainly be given more than a cursory glance during the year!

ANDERSON, BOYES & COMPANY, LIMITED, Motherwell—Large colour pictures, revealing the beauty of Scotland, illustrate a monthly wall calendar, which gives three months' dates on each sheet. The colouring is attractive and the calendar will doubtless brighten many an office during the coming year.

HUGH WOOD & COMPANY, LIMITED, Gateshead-on-Tyne 11—For the company's jubilee year of 1961 it is appropriate that its pocket diary should contain a potted history of the company and many photographs illustrating the contribution to mining efficiency made by Hugh Wood over the past 50 years.

WALLACETOWN ENGINEERING COMPANY, LIMITED, Ayr, Scotland—The "Glorious Isles" calendar contains magnificent reproductions of views of:—Castle Combe (Wilts); St. James's Park and Whitehall Building, London; sunset, near Bideford (Devon), and Colchester Castle (Essex). This calendar will spend the next 12 months on many a wall.

BAXTER, FELL & COMPANY, LIMITED, London, E.C.3—Beautifully bound, the company's desk diary contains much useful information, including lists of theatres, restaurants, hotels, and railway stations in the Metropolis and of the principal hotels in various provincial cities. The space for diary entries is generous and altogether the book is very acceptable.

INDIAN STEELWORKS CONSTRUCTION COMPANY, LIMITED—Mr. Harry Baines, whose paintings are used to illustrate Iscon's monthly wall calendar, was invited by the consortium to visit Durgapur to record his impressions of the steelworks under construction. He returned with dozens of paintings and drawings, a most interesting selection of which has been chosen for the calendar.

C. A. PARSONS & COMPANY, LIMITED, Newcastle-upon-Tyne—For many years past this company has sent out a monthly wall calendar in the "Our Heritage" series. The calendar for 1961 contains excellent reproductions in colour of views of many parts of the UK, among them views of the Thames at Cookham, Spanish Head from Calf Sound in the Isle of Man, the Stepping Stones at Dovedale (Derbyshire), Duntulm Castle, Isle of Skye, and the Druids Writing Desk, Brimham Rocks (Yorks).

HARRISON & SONS, LIMITED, London, W.C.2—In addition to being general letterpress printers—responsible for the weekly production of IRON AND COAL and many other publications—Harrison & Sons is renowned in many parts of the world for its printing in all processes, including postage stamps for this country and others. The calendar for 1961 carries six reproductions of works of art—"Eleanor of Toledo and Her Son" (Bronzino), "The Great Pine" (Cezanne), "Old Peasant" (Van Gogh), "House with the Cracked Wall" (Cezanne), "Sidewalk Café at Night" (Van Gogh), and "Adoration of the Magi" (Mantegna).

Canadian-built Wide Strip Mill

A SIX-STAND, wide strip mill as an extension to its bloom and plate mill, estimated to cost $30,000,000, is being built for the Algoma Steel Corporation, Limited, Sault Ste. Marie, Ontario, according to a report in the September 19 issue of Steel. It will be the first rolling mill of this type manufactured in Canada. The mill is scheduled for operation in 1963, producing hot-rolled steel sheets and light plates to a maximum width of 96 in.

The mill is expected to become a major supplier of sheet steel to the Canadian automotive industry which now imports all of its body stampings from the US. Import value of sheet steel and light plates from 12 countries into Canada last year totalled more than $41,000,000. In addition, Canadian automakers imported an estimated $80,000,000 worth of body stampings.

Contract for the mill was placed with the Dominion Engineering Company, Montreal, Quebec. The mill installation, with associated equipment, requires 9,000 tons of machinery with six main driving motors totalling 35,000 h.p. and auxiliary drive motors totalling over 10,000 h.p. The mill will require 240,000 sq. ft. of new buildings.

Electronic Structure of Metals

THREE lectures on "The Electronic Structure of Metals" are to be given by Prof. A. B. Pippard, FRS, John Humphrey Plummer Professor of Physics in the University of Cambridge and Fellow of Clare College, at the Imperial College of Science and Technology (New Physics Building) at 5.30 p.m. on February 2, 9, and 16.

The chair at the first lecture will be taken by Prof. M. Blackman, Professor of Physics in the University of London.

The lectures are addressed to students of the University of London and to others interested in the subject. Admission will be free and no tickets are required.

A SPOKESMAN of Allis-Chalmers (Aust.) Pty., Limited, has announced plans for expansion of production at the company's plant at Carrington, Newcastle (NSW), by about 30 per cent. About £200,000 will be spent at the works in the next few months. The plant produces earthmoving machinery, especially graders, bulldozers, power shovels, and crawler tractors. If the present demand continues, grader production will increase by about 50 per cent. in the next two years.

BISRA STEELMAKING CONFERENCE

The Theoretical Basis of OXYGEN STEELMAKING

by Dr. J. PEARSON

(*British Iron and Steel Research Association*)

This paper, the second presented at the 55th BISRA Steelmaking Conference, held at Harrogate on October 12 and 13, deals with the theoretical chemistry of oxygen steelmaking. It is complementary to the first paper of the conference, which was published in our November 18 issue.

A PREVIOUS paper[1] has described the mode of operation of the various oxygen steelmaking processes and indicated the nature of the changes in composition occurring while they are in progress. It is my task to attempt to explain why and how these changes occur so that those who have to operate the methods now or in the future will understand better what is happening and perhaps be able to regulate them to their wishes. I shall attempt to do this in relatively simple language.

Let me say at the outset that the title of this paper does not imply that it is possible to sit down with a textbook of thermodynamics and physical chemistry and evolve an accurate picture of all that happens in an oxygen-blown vessel. Far from it. An elucidation of events necessitates numerous observations, samples, and measurements on the process in operation, at least on a large pilot scale, followed by the relating of the results to basic data obtained in laboratory studies. Unfortunately, the newer processes have not received enough attention in this respect for us to be able to build a complete picture, though the position is rapidly changing.

The Thomas or Basic-Bessemer Process

I shall deal firstly with the Thomas process, the characteristics of which are early elimination of silicon, manganese, and carbon, the late removal of phosphorus, and the build-up of nitrogen. The process has been worked for a long time and the general chemistry is well appreciated. The changes that occur, except for the time taken, do not much depend on the oxygen content of the blast, so that for the moment the nitrogen may be forgotten. At the start of the blow the oxygen molecules probably dissolve in the iron, but very quickly come in contact with atoms of silicon, manganese, carbon, and phosphorus. Phosphorus is not affected at this stage because oxygen has a higher affinity for the other elements unless active lime (or other base) is immediately available, which is not the case. Its affinity for silicon and manganese is high so these are oxidized almost as fast as oxygen is supplied and are removed to low levels during the first few minutes of blowing. Some carbon is also removed during this period, as the reaction curves[2] in Fig. 1 show.

The slag that forms as a result is an acid manganese silicate, which at the temperature reigning dissolves hardly any of the added lime. Such a slag cannot retain phosphorus pentoxide except under very highly oxidizing conditions, which do not yet exist. Further blowing now removes carbon only and the slag still remains essentially the same, though the temperature is rising. When all the carbon is gone, the oxygen can form iron oxide. This combines with the initial manganese silicate and the lime to give a highly oxidizing basic slag, in the presence of which phosphorus can be oxidized to form dissolved calcium phosphate.

A relatively simple picture—firstly silicon and manganese only are oxidized. The resulting acid slag cannot hold phosphorus pentoxide, so no

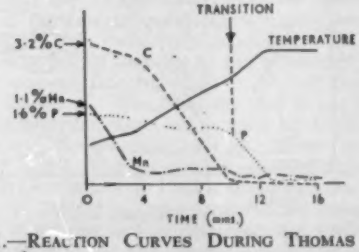


FIG. 1.—REACTION CURVES DURING THOMAS OPERATION[2].

oxidation of phosphorus is possible. Now carbon is removed and when it is gone, iron oxide can form and dissolve the lime to form the highly basic, highly oxidizing conditions known to be necessary for phosphorus elimination, which can therefore take place only during the after-blow.

Recent work[2] has shown that a little more detail can be added to this picture, particularly for events just before and during the after-blow. The start of the after-blow should be defined as that time when the phosphorus starts to be oxidized rapidly, rather than the end of the "carbon period," for, in fact, there is then some carbon left in the melt. The start of the phosphorus oxidation can be detected experimentally because the temperature record of the metal shows an inflection at this time (see Fig. 1). It might be best to use the German term "transition."

Fig. 2, which summarizes recent work at the Max-Planck-Institut in Düsseldorf[2], shows the carbon, oxygen, and nitrogen contents of the metal and the proportion of the original phosphorus removed, not as a function of time but of the volume of oxygen consumed, which is the really important variable. The first thing that strikes one is the odd shape of the oxygen curve. Before the transition, the oxygen content of the metal is held to a low level by the silicon, the manganese, and the carbon. When the latter has been nearly all removed, the oxygen content ought to rise steadily towards saturation (about 0.2 per cent.) unless the oxygen can combine in a slag with a lower oxygen activity than that of ferrous oxide.

The first slag that does form after the transition has a composition of silica, manganese oxide, iron oxide, lime, and phosphorous pentoxide such that it separates into two immiscible phases; one is FeO-MnO-rich and the other is rich in calcium phosphate. The former, as is to be expected, has a high iron oxide activity (and so has the phosphate-rich phase, because it is in equilibrium with it), though not as high as pure MnO-FeO slags.

The top curve in Fig. 2 shows the oxygen content of iron in equilibrium with MnO-FeO slags and makes allowance for the change of temperature and the manganese content of the metal during the blow. It is seen that the oxygen content of the metal rises parallel to, but at a somewhat lower level than corresponds to the pure MnO-FeO curve but at one that is in agreement with the dilution of the mixed oxides with lime, silica, and phosphorus pentoxide. In other words, the metal and slag are roughly in equilibrium with respect to oxygen. During this time lime is dissolving, slowly at first and then more rapidly until a point is reached when immiscibility no longer exists, the slag becomes homogeneous and its resultant iron oxide activity is lowered.

The lower curves in Fig. 2 indicate the oxygen contents in equilibrium with slags akin to those formed in the Thomas process. The iron oxide that existed at highish activity is now combined at lower activity and the oxygen then in the metal can form iron oxide in the slag and the oxygen content drops. As more oxygen is blown the iron oxide content of the slag rises and so does the oxygen content of the metal. Detailed analyses have shown that it is during the last third of the phosphorus removal period that the lime dissolves rapidly. It will be seen that during this period metal and slag are in near equilibrium with respect to oxygen.

The initial picture can therefore be modified to show that after the transition phosphorus starts to be removed while some carbon is present and is first removed by an iron-rich but not very basic slag and then the rest is removed when the lime content is much increased. The humped shape of the oxygen curve indicates that the phosphorus is removed initially by a slag of medium lime but high iron oxide activity, and finally by one of high lime but medium iron oxide activity and that in respect of oxygen, the metal and slag are not far removed from equilibrium. It also appears that phosphorous removal starts when the oxygen content of the metal reaches 0.02 to 0.04 per cent.

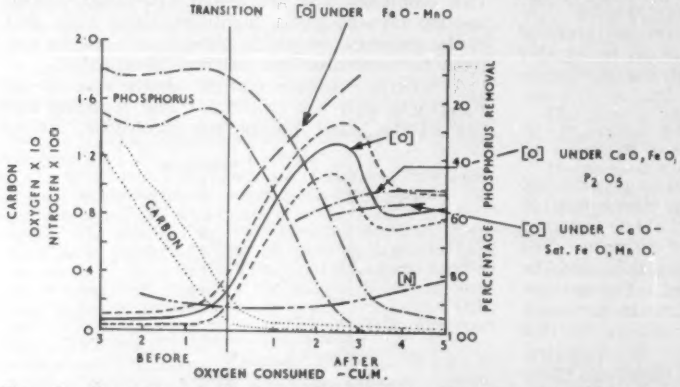


FIG. 2.—CHANGES IN CARBON, PHOSPHORUS, OXYGEN, AND NITROGEN TOWARDS THE END OF THOMAS OPERATION[2] AS A FUNCTION OF VOLUME OF OXYGEN CONSUMED.

It is of interest to inquire whether there is any equilibrium between dissolved carbon and oxygen and carbon monoxide during the blow. It is to be expected that, in a system so abundantly provided with bubbles to act as nuclei or sinks for carbon monoxide, equilibrium would be easy of establishment. From the values on which Fig. 2 was based it is possible to show the relationship of carbon and oxygen during blowing. This is shown by the dots in Fig. 3. The solid line makes allowance for the dilution of the carbon monoxide with nitrogen. It will be observed that, except at very low

carbon contents, the oxygen is always above equilibrium. Similar data from open-hearth operation[3] are included in the figure as crosses.

It can be said that, in both processes in spite of the turbulence of the boil (spontaneous or induced by blowing), carbon and oxygen are not at equilibrium and that the metal is more oxidized than the carbon content would indicate. This has importance in connection with top-blowing.

The other characteristic of the Thomas process is the pick-up of nitrogen. This gas has a fairly high solubility in iron (from 0.03 to 0.04 per cent., at the temperature concerned) which increases with temperature. Because nitrogen is blown through the metal, it should be absorbed readily. The nitrogen curve in Fig. 2 shows that this is not the case. While carbon is being removed rapidly, the evolved carbon monoxide flushes out not only the nitrogen in the blast but some of that in the original iron.

Even when there is little carbon left and the temperature is rising during phosphorus elimination, nitrogen is absorbed only slowly. It is when the oxygen hump is passed that the nitrogen content really starts to rise, *i.e.*, a high oxygen content inhibits nitrogen pick-up (though why is not clear), but when the content is lowered absorption is possible. Other work has shown this to be true. When pick-up *is* possible, it is favoured by high temperature (solubility and reaction rates increase with temperature), time of blowing, nitrogen partial pressure in the blast, and time of contact of the blast with the metal. For this reason, nitrogen contents may be kept relatively low if the blow is conducted with a shallow bath, if some of the oxygen required is provided by ore, if coolants are used, and if the heat is run so that temperatures remain low until just before tap.

It was said above that reducing the partial pressure of nitrogen in the blast should reduce the nitrogen content of the steel. This, however, depends on how the nitrogen is diluted. The curve in Fig. 2 shows that the nitrogen is absorbed during the latter part of the blow and during this time the only chemical reaction taking place is the oxidation of phosphorus and iron; all the oxygen in the blast is being consumed.

If the air blast is enriched with oxygen to dilute the nitrogen, the waste gases leaving the upper layers of the metal are still pure nitrogen. It is only if the blast is diluted with a gas that is inert or gives rise to essentially inert products that the partial pressure of nitrogen can be reduced and so lower nitrogen contents be obtained.

Steam and carbon monoxide will react with the metal to oxidize it and form hydrogen and carbon monoxide and these gases would act to dilute any nitrogen in the original blast. But to obtain really low nitrogen contents it is best to leave all nitrogen out of the blast and work with oxygen-steam or oxygen-carbon dioxide mixtures.

Addition of steam is known to reduce the amount of iron oxide fume formed during Thomas operation. There have been past conferences and Iron and Steel Institute meetings on the topic of fume

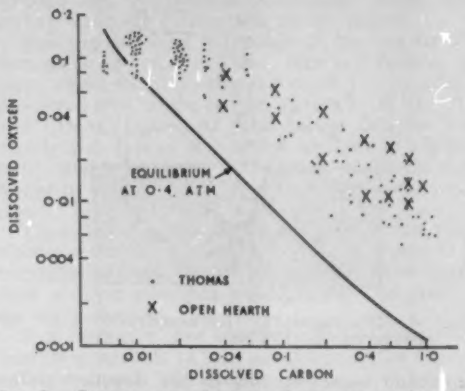


FIG. 3.—CARBON AND OXYGEN CONTENTS IN THOMAS AND OPEN-HEARTH OPERATION.

and we have discussed possible mechanisms for its formation and have had to admit our ignorance. Iron may be volatilized simply as a result of high temperature or through some as yet unknown chemical intermediary. By whatever mechanism fume is formed, reaction rate will increase with temperature and since steam is a coolant, its presence should lower the rate.

Top-blowing with Oxygen

It has been indicated that in bottom-blowing, phosphorus removal was delayed until a slag was formed containing sufficient lime to combine with the phosphorus pentoxide and until the oxygen content of the metal had been raised to 0.02-0.04 per cent. It is true that this involved the removal of almost all the carbon, but since there was no close connection between the carbon and oxygen contents, it is probable that if the necessary high oxygen content could be established in some other way, phosphorus could be removed while carbon was present at quite high concentrations.

If, with all the agitation of bottom-blowing, conditions are so far from carbon-oxygen equilibrium, perhaps—and this is being wise after the event—if oxygen were blown on to the metal and slag without making too much disturbance it would be possible to get even further from equilibrium, start phosphorus removal at high carbon and complete it before reaching tapping carbon.

It must be remembered that for phosphorus removal there is no need for a highly basic slag so long as it is sufficiently oxidizing. This refers to the slag proper and not to the gross composition of the non-metallic material on top of the metal. If the lime is not dissolved, the slag is not basic.

What happens when an oxygen jet impinges on the metal in the LD process, using low-phosphorus iron? The jet used is of high speed and, therefore, turbulent and has a shape like that shown in Fig. 4. As far as can be ascertained from model work[4], it creates a depression on the surface, not very deep, and the gas stream is deflected upwards and outwards. The flow over the walls of the

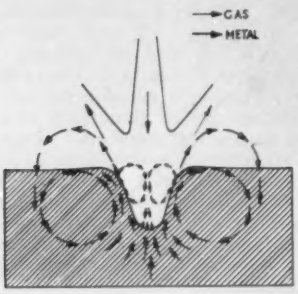


FIG. 4.—DIAGRAMMATIC REPRESENTATION OF THE ACTION OF AN LD JET[4].

depression causes stirring in the direction shown by the arrows. Metal droplets are also whipped off the rim. Oxygen will dissolve in the metal and for the reasons given before will attack firstly the silicon and manganese; the reaction curves in Fig. 5 show that these two elements are rapidly removed[5].

Because the iron surface is freely exposed to the oxygen and because there are iron droplets in the deflected stream, iron oxide can also form and within a very short while this has dissolved some lime to give a highly oxidizing but not very basic slag. This is illustrated in Fig. 5 of a scrap-cooled heat. Here it is seen that an oxidizing slag is soon formed with a lime content of less than 20 per cent. Indeed, during the early stages the lime content of the slag, as such, actually decreases because the lime is not dissolving fast enough to match the rate of iron oxide formation.

The top part of the figure shows that although the slag weight increases rapidly, the lime does not dissolve fully until late in the blow. It can be calculated that such a slag with a constant P_2O_5 content, slowly falling silica and manganese oxide contents, a rapid rise and then fall in iron oxide, and a fall and a slow rise in lime will exhibit an initial rapid rise in oxidizing power, followed by a fall, approaching at the end of the blow a state of oxidation not much different from that of the tapping slag in the open-hearth furnace. There is thus formed early an oxidizing slag with an oxidizing power that stays essentially constant (see later), but whose basicity rises fairly steadily—ideal conditions for dephosphorizing.

The oxygen content of the metal should change roughly in line with oxidizing power of the slag, or *vice versa*, and Fig. 6 shows that this is indeed the case[5]. The uppermost curve inserted in this figure shows the oxygen content of iron that would be in equilibrium with the slags whose compositions are shown in Fig. 5. Fig. 6 also shows the corresponding line for equilibrium with open-hearth slags[3] and the mean carbon-oxygen values in the metal.

Just as with open-hearth operation, where the slag is much more oxidized than the metal, so is the LD slag much more oxidized than the metal. Before the carbon has dropped to 3 per cent the apparently critical oxygen content of 0.02-0.04 per cent. has been exceeded and rapid phosphorus oxidation is possible at that time. Such oxidizing conditions ought to be conducive to carbon oxidation. However, Fig. 6 shows that the carbon-oxygen reaction is far from equilibrium and at the early stages of the blow is much further from equilibrium than is the open-hearth at the same carbon contents. This must mean that the evolution of carbon monoxide is less favoured in the LD process.

It will be seen that there is some similarity between the Thomas and the LD processes. When there is a sudden rise in the oxygen content of the metal, phosphorus starts to be removed or, *vice versa*, when phosphorus starts to be removed there is a sudden rise in dissolved oxygen in the metal, followed by a fall, rapid in the Thomas process because of the change in the physical nature of the slag, but more slowly in the LD, because with the low P_2O_5 contents there will be no immiscibility. As the carbon content is progressively lowered there is a gradual increase in the oxygen content of the metal in both processes, as is to be expected.

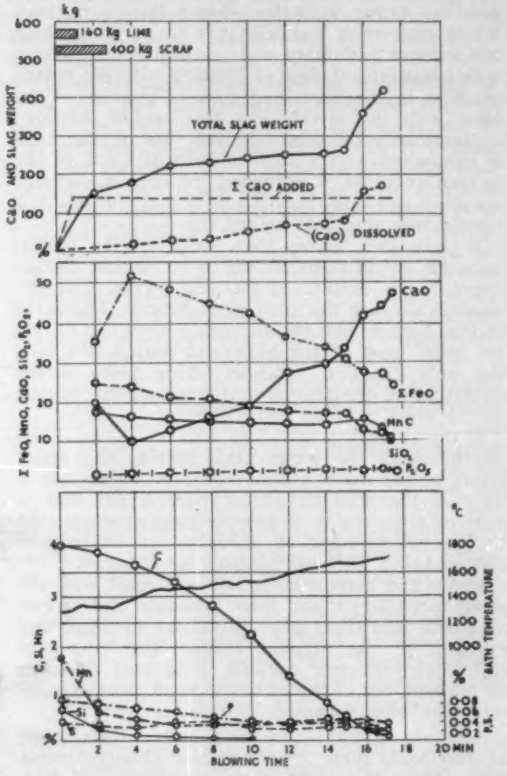


FIG. 5.—REACTION CURVES DURING LD OPERATION[5].

These considerations indicate that in the LD process, early dephosphorization occurs because a highly oxidizing slag is soon formed with a high enough lime content to combine with phosphorus pentoxide and because the carbon elimination, though fairly rapid, is sluggish enough not to prevent the high state of oxidation being maintained.

The position will be much the same when dealing with high-phosphorus irons by the LD process. However, the phosphorus pentoxide contents of the slag will build up to a much higher level and this will inevitably tend to make removal of phosphorus more difficult, *i.e.*, necessitate a higher iron oxide content in the slag. If the phosphorus is difficult to oxidize then carbon removal will be favoured and there will be the danger of reverting to the position as in the Thomas process that an after-blow is necessary to reach desirable phosphorus levels.

The obvious course, therefore, is to take off a first slag before the phosphorus pentoxide and iron contents get too high and carbon elimination speeds up but, on the other hand, high enough in phosphorus pentoxide to make the slag saleable. The introduction of further lime and a repetition of the blowing will then reproduce the conditions of a low-phosphorus iron heat. Depending on the phosphorus and silicon contents of the iron it may be advantageous to take off more than one slag so as to observe the conditions mentioned above.

When there is much phosphorus to be removed everything should be done to favour the early elimination of this element. In straight LD operation it is necessary to wait for the iron oxide produced to make contact with and dissolve the lump lime; this takes some time. If this phase could be speeded up, phosphorus elimination could start earlier while the carbon was all the higher.

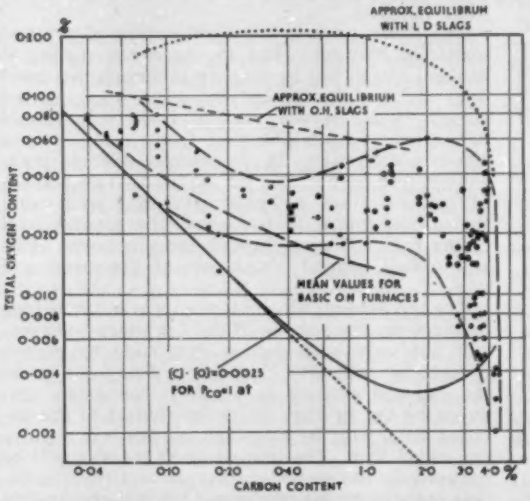


FIG. 6.—CARBON AND OXYGEN CONTENTS IN LD OPERATION[5], AND OXIDIZING POWER OF SLAGS.

This can be done if, instead of waiting for the iron oxide to reach the lime, lime is forced to the place where the iron oxide is formed, *i.e.*, by adding powdered lime to the oxygen stream as in the OLP and LD-AC processes. This means that the lime dissolves as fast as it is added so there is a highly basic, highly oxidizing slag that contains no solid lumps to act as nuclei for carbon monoxide evolution.

These are chemical conditions that favour phosphorus removal. Unfortunately, there appear to be no carbon-oxygen figures for samples taken during such an operation that would enable this point to be really checked.

It is, however, not necessary to use lime injection; it is possible to take advantage of the changes brought about by altering the position of the lance, though double slagging will still be required. It was said above that early phosphorus removal would be promoted if the lime could be dissolved quickly to form a liquid oxidizing slag, and if carbon monoxide evolution could at least be partially suppressed.

Under normal operation, the iron oxide is allowed to act on the lime while the oxygen jet penetrates to the metal. If at the stage when the first slag has formed, the jet pressure is reduced or the distance of the gun above the metal surface is increased, it is possible to reach a situation where the oxygen contacts only the slag. This will oxidize ferrous oxide to ferric oxide which is a more powerful flux than ferrous oxide. By diffusion and stirring, the ferric oxide will reach the slag-metal interface and oxidize phosphorus.

Such conditions are not conducive to carbon monoxide nucleation and this method should achieve the desired result. This is essentially the "buffer-slag process"[6]. Unfortunately, with no penetration of the jet into the metal and little carbon monoxide evolution, the metal remains static and phosphorus atoms will be slow in reaching the surface where they can be oxidized. This is confirmed in practice, because the buffer-slag process does take a long time.

At some intermediate stage, the oxygen contacts the metal *and* plays on the slag. Metal droplets thrown off from the depression in the metal will be oxidized rapidly to form ferric oxide which can flux the lime present. This ferric oxide will, in oxidizing phosphorus, be reduced to ferrous; analyses are not likely to tell much of the actual state of oxidation of the iron oxide, but, provided that there are metal drops to be oxidized, the higher the lance the higher the iron oxide content of the slag[7].

Ideally this procedure could be worked with two lances, one to react on the metal and the other on the slag[8]. The two lances may be combined, as reported by the Mannesmann company. The relative proportions of oxygen

through the two parts of the lance or the height of the lance then gives the possibility of varying the rates of gas-slag and gas-metal reactions and so obtaining the optimum compromise between fast dephosphorization and carbon removal. Mannesmann reports have shown that by working in this way with lump lime additions, results similar to those by the LD-AC and OLP processes can be achieved[7].

Importance appears to be attached to foaming, or controlled foaming, of the slag and it should be asked whether foaming is necessary for phosphorus removal or whether it is merely a consequence of the conditions under which phosphorus is easily oxidized. It was suggested that the aim of the blowing operation is a highly oxidized liquid slag and sufficient jet penetration to stir the metal and bring phosphorus atoms to the surface. If this is the case, then droplets of liquid metal will be swept into the slag. These, because of their large surface area, react with the iron oxide and produce carbon monoxide, bubbles of which inflate the slag. The extent to which they do so will depend on the slag composition and it is expected that this will vary with the silica and phosphorus pentoxide contents and thus on the composition of the hot metal.

If the lance is lowered so much that there is little oxidation of the slag, the drops of metal will not be oxidized and carbon monoxide formation from them will subside. Foaming therefore indicates that the correct slag conditions are present and that there is a sufficient stirring of the metal to make phosphorus available. The Mannesmann company used the degree of foaming as a guide to the correct compromise and varied the lance position during the blow to achieve it[7].

From this it will be seen that foaming is not necessary for phosphorus removal, but that it is likely to happen at the same time. It is claimed by French workers that in the OLP process there is little foaming. This could be because it is not necessary, with lime injection with the oxygen, to have oxidation of the slag to ensure rapid solution of the lime.

The Kaldo and Rotor Processes

What has been said already forms a basis on which to discuss the Kaldo and Rotor processes. In the former, the oxygen jet plays essentially on the slag and will establish the chemical conditions for early phosphorus removal and retention of carbon. But the physical conditions to bring phosphorus atoms to the seat of reaction must be induced in some other way. Kalling has chosen, if that is the right way to look at it, to use rotation of the vessel. This will mix the slag and metal and cause rapid relative movement between them.

Control of gas-slag and slag-metal reactions then becomes possible by varying the rate of revolution. If the rate is very low, a highly oxidized slag will form which will oxidize more iron and also remove the phosphorus that gets to the slag-metal interface. Speeding up the rate will make more phosphorus available in a given time and tend to reduce the state of oxidation of the slag. Some carbon will also be oxidized.

Very fast rotation, while *a priori* favouring phosphorus removal, will also stimulate rapid carbon oxidation; this will reduce the state of oxidation and inhibit phosphorus elimination. In fact, some Kaldo blows are conducted so that, over about the first third of the process, a liquid slag is not formed and only silicon, manganese, and carbon are removed.

Phosphorus elimination is accelerated when the slag has reached a higher temperature and has melted. The first stage of the blow is terminated with carbon well below the phosphorus, but in the subsequent finishing blow, the conditions are chosen to remove phosphorus faster than carbon and a satisfactory low-phosphorus, low-carbon steel is produced[9].

For other purposes, the first stage may be conducted to remove carbon and phosphorus together or even phosphorus at a faster rate than carbon. This is varied by changing the speed of rotation and the angle at which the oxygen stream impinges on the slag[9].

One feature of the Kaldo operation is that the approach to equilibrium can be accelerated by the rotation. To obtain a rapid phosphorus removal, the iron oxide content of the slag is higher than that necessary to maintain the phosphorus level reached. If the vessel is rotated rapidly it is possible to cause the excess oxide to react with the metal and desirably low slag iron contents can be obtained.

There are probably as many ways of conducting a Kaldo blow as there are types of raw material and products to be made, but the principles discussed already should present a general picture of what happens.

The Rotor process is a combination of top and immersed blowing. Here the necessary stirring is brought about, not by rotation (although the vessel does revolve slowly) but by using an immersed lance[10]. The oxygen issuing from this should behave very much like that from a tuyere in a Thomas converter. In its vicinity silicon, manganese, and carbon will be oxidized. The bubbles of gas will form a "pneumatic lift" and cause the inflated metal to rise above the general level of the bath and even through the slag cover. This will induce general circulation of the metal and slag.

The top oxygen, which represents as much as four to five times the volume of the "primary" oxygen, will not only burn carbon monoxide to carbon dioxide but will also have an oxidizing action on the slag and exposed metal. Any iron oxide, produced by the primary jet or by contact of the exposed metal with the secondary oxygen, will dissolve the added lime. The iron oxide in the slag will be oxidized by the secondary oxygen and the circulation induced by the pneumatic lift will ensure that that makes contact with phosphorus atoms in the metal.

The chemistry of the process is thus essentially the same as that of the Kaldo and not much different from that of the LD (or, for that matter, open-hearth) operation. It is merely the physical methods adopted to produce the correct slag and mix it with the metal that vary.

The Kaldo and Rotor processes take rather a longer time than does the LD. Is this a limitation that need be accepted? In all the top-blown methods under discussion oxygen is used at about 100 per cent. efficiency, *i.e.*, no matter by which method the oxygen is transferred into oxidation products, it is consumed as fast as it is added.

Could it be added faster? Not faster because a bigger charge of iron is used, but faster in terms of cubic feet per ton per minute. It probably could. Whether it is desirable is another matter. There *is* a limit beyond which it would be undesirable to go. The faster a process takes place the more difficult it is to control compositions and temperature at any stage.

Particularly for catch carbon practice, a slower method has advantages and until instrumental control methods have been developed much further than they are today, it may be as well to work some steelmaking processes at less than the maximum speed.

Apart from dealing with carbon and oxygen, nothing has been said about the extent to which other reactions involving metal and slag approach equilibrium. Such evidence as there is seems to indicate that in Thomas operation, the concentrations of manganese and phosphorous at any time during the later stages of operation are fairly close to equilibrium[2], in general, the slag seems a little more oxidizing than is necessary for the concentrations existing. This excess could be regarded as being required to drive the reactions forward.

In LD operation, the early slag contains much more iron oxide than is required to maintain the manganese content, but when basic conditions have been established, the excess is much reduced. When blowing is stopped, the manganese reaction quickly comes to equilibrium[5]. Whether this is true for the phosphorus reaction is not yet known. In Kaldo and Rotor steelmaking, it would appear that again the slag is much more oxidizing than equilibrium conditions would suggest, but that if the agitation is increased or oxygen supply discontinued, equilibrium is closely approached.

REFERENCES

[1] E. A. Hacking, IRON AND COAL, 1960, **181**, Nov. 18, 1107.
[2] W. A. Fischer and H. Straube, *Stahl und Eisen*, 1960, **80**, Sept. 1 1194.
[3] E. T. Turkdogan and J. Pearson, *JISI*, 1954, **176**, 59.
[4] R. Hammer, T. Kootz, and J. Sittard, *Stahl und Eisen*, 1957, **77**, Sept. 19, 1303.
[5] E. Plöckinger and M. Wahlster, *Techn. Mitt. Krupp*, 1959, **17**, 295.
[6] H. Kosmider, H. Neuhaus and H. Schenck, *Stahl und Eisen*, 1957, **77**, Sept. 19, 1277; F. A. Springorum, K. G. Speith, O. Därmann, and H. v. Ende, *Stahl und Eisen*, 1957, **77**, Sept. 19, 1284.
[7] K. G. Speith, H. v. Ende and F. Bardenheuer, *Stahl und Eisen*, 1960, **80**, May 26, 733.
[8] H. Rellermeyer, H. Knüppel and J. Sittard, *Stahl und Eisen*, 1957, **77**, Sept. 19, 1296.
[9] B. Kalling, F. Johansson and E. Bengtsson, *J. Metals*, 1960, **12**, July, 558.
[10] R. Graef, *Stahl und Eisen*, 1957, **77**, Jan. 10, 1.

MEASUREMENT OF STRIP SPEED

CONTINUOUS measurement of the reduction in gauge in the temper rolling of steel strip is still a relatively unsolved problem. One approach is to compare the speeds of the strip before and after rolling; the increase in speed is, of course, directly proportional to the percentage reduction in gauge. Magnetic methods of measuring strip speeds have been tried, but were found too sensitive to up-and-down movement of the strip in the neighbourhood of the measuring instruments.

The British Iron and Steel Research Association is developing a new method in which two photocells are set on two illuminated spots on the strip surface, the two spots being a fixed distance apart and lying along the passline. Small irregularities in the light reflected from the strip surface give rise to a pattern in the output of the first photocell. After an interval of time, depending on the distance apart of the two photocells and the strip speed, another similar pattern appears in the second photocell. Thus, if the output of the first photocell is delayed (*e.g.*, on a tape recorder) and then added to the second photocell signal, a maximum combined output will be obtained when the delay time introduced is equal to the time for passage of a point on the strip surface between the two photocells. From this delay time, and the known distance between the illuminated spots, the strip speed can be readily calculated.

A prototype appliance covering the new method is to be exhibited by BISRA at the Physical Society Exhibition in January, together with other devices developed by the association.

BISRA has produced in prototype form a unit designed to reproduce on a single flat plate an image of the complete surface of a cylindrical specimen. It has been used to make permanent records of the condition of short lengths of cast-iron and steel pipes after they have been subjected to soil corrosion.

Tinplate and cold-rolled strip need to be inspected during manufacture for surface defects or blemishes. At high line speed this can no longer be done by the unaided eye. The factors involved in rendering the fault visible may not be explicitly appreciated, and exhibits by BISRA will demonstrate techniques employed in developing instrumental aids to visual inspection, as well as for studying the feasibility of fully automatic high-speed inspection.

New Literature

CATALOGUES, booklets, and other publications recently received include those mentioned below. Readers wishing to obtain a copy of any of the publications referred to should apply direct to the address given, at the same time mentioning IRON AND COAL.

J. H. FENNER & COMPANY, LIMITED, Hull—Leaflet 253/20 gives information on the Fenner-Dodge split journal and solid journal bearings.

PYE TELECOMMUNICATIONS, LIMITED, 1, Carrol Place, Highgate Road, London, N.W.5—Examples of the company's equipment in operation at the works of the Steel Company of Wales, Limited, are given in an article in the November issue of News Letter.

LINCOLN ELECTRIC COMPANY, LIMITED, Welwyn Garden City (Herts)—Included in the autumn issue of the Stabilizer is a feature on "Scotland's Gas Supergrid." The application of the "Arcair" process for the gouging or cutting of metals in the shipyard is the subject of another article.

MOND NICKEL COMPANY, LIMITED, Thames House, Millbank, London, S.W.1—Abstracts contained in the November issue of the Nickel Bulletin provide, in the diversity of their subject matter, an apt illustration of the wide range of industries and applications in which nickel and nickel-containing materials play an important role.

TEES-SIDE AND SOUTH-WEST DURHAM CHAMBER OF COMMERCE, North-Eastern Bank Chambers, Marton Road, Middlesbrough—Month by month, the Tees-side Journal of Commerce presents a useful picture of industry and trade conditions in the area. The December issue contains news of various undertakings in heavy industry, together with comment by several leaders of industry.

TURNER BROS. ASBESTOS COMPANY, LIMITED, Rochdale (Lancs)—A new publication (D4) covers the complete range of "Duraglas" glass-fibre woven tapes for electrical insulation. It includes details of tape construction, tensile strength, conductivity, and pH of aqueous extract, together with general information on the use of "Duraglas" tapes. A number of user illustrations are also included.

EDGAR ALLEN & COMPANY, LIMITED, Imperial Steel Works, Sheffield 9—A second instalment in the series "The Machining of Steel," by Dr. F. C. Lea and Mr. Eric N. Simons, is included in the December number of Edgar Allen News. Various other technical articles are continued from previous issues, while there are several other features of considerable interest to all associated with metallurgical matters.

APPLEBY-FRODINGHAM STEEL COMPANY (branch of the United Steel Companies, Limited), Scunthorpe (Lincs)—Despite lingering doubts held by the editorial staff, the winter number of the Appleby-Frodingham News did reach readers before the season for conveying Christmas greetings had expired, and a first-class issue it is, too. "App-Frod" people can write as efficiently as they make their steel, most of the contents of the magazine being contributed by members of the company. It is all very readable and handsomely presented, several pages of easy-on-the-eye colour adding much to the appearance of the production.

PRESSED STEEL COMPANY, LIMITED, Cowley, Oxford—An editorial in the December issue of Press Express says: "The spring, 1960, issue dealt with good news. This December one has unfortunately to deal with difficult times." Much space is devoted to a forthright picture of the motor industry as it approaches the end of the year, a year which, as Mr. M. A. H. Bellhouse, the deputy chairman, says, "began brightly," but "is now ending with disappointments which we hope will only be of short duration." On the brighter side, there's a two-page feature in colour for Christmas containing a quiz and many other items designed to appeal to every member of the family.

DORMAN, LONG & COMPANY, LIMITED, Zetland Road, Middlesbrough—Excellent photography and first-class layout do much to enhance the material contained in "Dorman, Long Illustrated: 1960." The features include articles on "Interiors of Dorman, Long Steel-framed Buildings," "Growth of a Bridge" (the one crossing the river Mersey and the Manchester Ship Canal and linking Runcorn and Widnes), "From Steam to Diesel," and "Limestone in Wensleydale." In a foreword, Sir Ellis Hunter, chairman and managing director, says: "1960 has been a year of improved demand for our steel products. It has been heartening for us all to have outputs in the iron and steel works at record levels and to see our new modern plants getting into their stride. Improvement in the order-books of the bridge and constructional engineering departments was slower in developing, but the position was more satisfactory in the final quarter."

1961 EDITION OF THE "FBI REGISTER"

THE 1961 edition of the "FBI Register of British Manufacturers," now available, is a comprehensive and accurate guide to a substantial cross-section of British industry, containing lists of the products and services of nearly 8,000 member firms under more than 5,400 alphabetical headings. In addition to the classified buyers' guide there are seven other sections, giving addresses of companies and firms, and valuable information about trade associations, proprietary names, trade marks, etc. The French, German, and Spanish glossaries give translations of every product term used in the main buyers' guide, each being numbered for easy reference between the English headings and their translations.

The "FBI Register" is published, in close collaboration with the Federation of British Industries, by Kelly's Directories, Limited, 186, Strand, London, W.C.2, and Iliffe & Sons, Limited, Dorset House, Stamford Street, London, S.E.1, at 50s. post free. The size is 9½ in. by 7½ in. and it contains 1,162 pages.

A LOAN equivalent to $25,000,000 to Norway further to assist in financing the Tokke hydro-electric development scheme has been made by the World Bank. The Tokke undertaking, the largest hydro-electric power project in Norway, will consist of three power plants having a combined capacity of 810,000 kW; transmission lines will also be built to connect networks serving southern and western Norway and to provide a connection with the Swedish grid for the export of power.

PAPERS SET AT

COLLIERY MANAGERS' EXAMINATIONS

TEXT has been published of the papers set at the examinations held under the Mines and Quarries Act, 1954, by the Mining Qualifications Board on November 15, 16, and 17. The questions for the first-class colliery managers' examinations are given below. Maximum number of marks given for each question was 20. Five questions only were to be answered for each paper.

The time allowed for each paper was 3 hr., with the exception of that on mining legislation, for which 2½ hr. was allowed.

Winning and Working

(1) An area of coal in a yard seam at moderate depth is to be worked to produce a daily output of 1,000 tons. Mining conditions are good. With the aid of sketches describe how you would lay out and develop the area up to this output with particular regard to:—

(*a*) Method of working at the face,

(*b*) roadway maintenance, and

(*c*) transport of coal and materials handling.

(2) A 22-ft. dia. (finished) shaft is to be sunk through 60 ft. of mixed clay, gravel, and wet sand, and 240 ft. of heavily watered limestone to reach the underlying Coal Measures. Describe, with the aid of sketches, the sinking operations through the first 60 ft., giving details of the lining employed; state briefly how sinking would be continued through the limestone.

(3) Describe, with the aid of sketches, one type of self-advancing face roof support. State in what circumstances the support should be used and what advantages should be obtained from its use.

(4) Explain how good shotfiring techniques can assist in increasing the yield of large coal at the coal face. What suitable alternatives are available to the use of permitted explosives for increasing the yield of large coal?

(5) An output of 2,000 ton/day of 12 hr. loading is to be conveyed along a roadway 14 ft. by 10 ft. and 1,600 yd. in length, rising 1 in 20 to the loading point. Describe the conveying equipment and auxiliaries that should be installed and the arrangements that should be provided at the loading point for the easy handling of the tubs or cars.

(6) Outline the factors which govern the direction, gradient, and cross-sectional area of pit-bottom roadways through the shaft pillar and beyond as main roadways.

(7) Indicate the advantages of the following methods of dirt disposal on the surface of collieries:—(*a*) By dumper trucks, (*b*) by aerial ropeway, and (*c*) by conveyors. Describe one method from the shaft side to the point of disposal.

(8) What are the advantages and disadvantages in the use of inclined mines as compared with vertical shafts both in the driving and the subsequent working of coal seams?

Theory and Practice of Ventilation

(1) Fig. 1 shows the characteristic curves of an auxiliary fan. Determine the quantity of air which two such fans in series would deliver through an airtight duct having a resistance of 7,280 Atkinsons. State the power which would be absorbed by each fan in these circumstances.

(2) A mine ventilation circuit consists of two main airways and two districts A and B in parallel, through which respectively 30,000 and 60,000 cu. ft. of air flow/min. The pressure across the shafts at the pit bottom is 5 in. w.g. and that across the district 4 in. w.g. If the quantity in district B is regulated to equal that flowing in district A, what percentage saving in power would be effected? Assume no leakage; that the pit-bottom pressure remains constant and that the pressure losses in the shafts are negligible.

(3) Itemize, and express as a percentage by volume, the various constituents of ordinary atmospheric air.

Explain why the oxygen percentage decreases in mine air as it flows through a mine, and state the additional gases which may be found in the return air, giving their mode of origin.

(4) A persistent layer of firedamp is present along the roof of a level mine roadway. Discuss the probable causes of the layer and the methods which might be used to disperse it and to prevent its reforming.

(5) A conveyor panel has been worked to the rise for a distance of 800 yd. from a level main intake and main return airway, the full dip being 1 in 4. After restarting the mine fan following a prolonged stoppage due to a breakdown, it is found that no air is circulating through the rise district, and that the top end of the district is filled with firedamp at high concentration for a distance of 200 yd. down both gate roads from the face. The maximum ventilation pressure difference available between the main intake and main return airway at the bottom of the gate roads is 0.5 in.

w.g. Describe in detail how you would restore normal ventilation in the district.

(6) Discuss, with the aid of diagrams, the relative merits of the various methods of ventilating a long cross-measures drift advancing to the rise.

(7) A fan is installed midway along a length of ventilation ducting having a conical diffuser at the outlet end. Draw graphs, using any suitable scales, to show the relationship between the total, static, and velocity pressures respectively in the duct throughout its length, and also how these pressures vary along the duct. It is not necessary to calculate values of the pressures from assumed conditions.

(8) A new mine is to be equipped with duplicate electrically driven, single-inlet, radial-flow mine fans. One fan is intended to be standby to the other. Make an outline sketch of a suitable layout of the fan installation, including the fan-drift from the upcast shaft, the fans themselves, the fan drives, and the fan motor house. Show all the necessary doors and indicate how the airflow would be reversed in case of emergency.

Explosions, Underground Fires, and Inundations

(1) In a seam liable to spontaneous combustion and with a high methane yield, the rise side of a longwall face is advancing and keeping contact with the waste of an abandoned face. Discuss the fire hazard of such a system of work and describe the precautions necessary while working and during the period of final abandonment of the face.

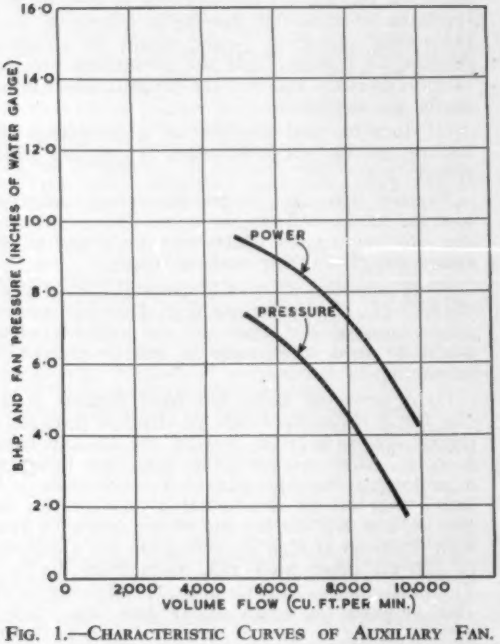


FIG. 1.—CHARACTERISTIC CURVES OF AUXILIARY FAN.

(2) Following a fire at the coal face in a very gassy seam it has become necessary to seal off the area. Discuss the selection of suitable sites for the stoppings.

(3) Under what conditions may a coal dust explosion be propagated in a mine? Discuss the methods of reducing the hazard of such an explosion.

(4) How may breathing apparatus of the self-rescuer type save life in mines affected by explosions or fires? State the limitations of such apparatus and the essential requirements for their successful use.

(5) Describe, briefly, some of the more recent developments in the safe utilization of explosives in mines.

(6) Describe, with the aid of sketches, the long-hole infusion method of dust suppression and discuss the limitations of this method.

(7) An exploratory heading in a coal seam with a friable roof has approached within 60 yd. of an area of waterlogged workings to the rise in the same seam. What precautions should be taken while gaining access to the waterlogged workings?

(8) As manager of a mine you are informed, while on the surface, that dense smoke is issuing from the main return airway of a large district. What would you do?

Machinery

(1) Discuss the relative advantages and disadvantages of:—(*a*) Cable belts; (*b*) conventional types of belt conveyor, and (*c*) plate conveyors.

State the ranges of duty for each type of conveyor. What are the factors to be taken into account in deciding the horsepower required to drive a heavy duty conventional conveyor of 400 ton/hr. capacity?

(2) A pump driven by an electric motor is required to deliver 600 gal. of water/min. against a total head of 1,100 ft. The supply is 3 phase a.c., at 3,000 V. If the overall efficiency of motor and pump is 75 per cent., and the power factor is 0.9 lagging, what current will be taken by the motor?

State the type of pump, motor, and switchgear you would install, and give reasons for your choice.

(3) A locomotive hauls a train of loaded mine cars on an incline graded in favour of the loads. The gradient is such that the rolling friction of the mine cars is exactly balanced by the gravitational effect of the gradient. If the rolling friction of the mine cars and locomotive is 16 lb./ton calculate, (*a*) the gradient of the incline, and (*b*) the horsepower developed by a 12-ton locomotive when accelerating a train of loaded cars of gross weight 120 tons at 0.25 ft./sec. at a speed of 5 m.p.h.

(4) A fully mechanized single unit face is to be worked using two 60-h.p. stable hole coal-cutters, one 80-h.p. Anderton shearer, a twin 50-h.p. motor armoured flexible conveyor, two 1½-h.p. drills, one 7-h.p. hydraulic power pack for conveyor pushers, and a 40-h.p. stage loader.

Specify, (*a*) the size of transformer(s), (*b*) the size of cables, and (*c*) the types of switchgear. If the L.T. voltage at the transformers is 550 V., and the power factor is 0.8, calculate the maximum line current in the L.T. feeder cable(s) to the face switchgear (for this purpose neglect line losses), and state whether you consider that this value warrants a single cable feed or twin cable feeds from the transformer(s) to the face. Give reasons for your choice.

(5) Draw a winding cycle diagram for a cylindrical drum winder, (*a*) with a balance rope, and (*b*) without a balance rope, showing how the horsepower varies during the cycle.

Name the various parts of the cycle, and explain any variations in power during each part. What is the reason for the difference between the two diagrams?

(6) A skipwinding shaft is to be fed underground from one 48-in. feeder belt and is to be capable of handling 2,500 tons of run-of-mine coal per shift on double-shift winding. Sketch and describe the layout and type of equipment installed between the feeder belt and the skip. The capacity of the latter is 10.5 tons.

(7) State how the method of changing the energy of steam into work differs in a steam engine and a steam turbine. Make a sketch of the nozzle, a blade, and the blade wheel of a simple turbine. Indicate in two adjacent columns the advantages and disadvantages of steam turbines.

(8) Explain why a squirrel cage motor takes a heavy starting current. When the motor is running normally, the current it takes varies according to the load on the motor. Explain why the current increases as the load increases. Describe a method of safeguarding the motor against continued excessive overload.

Surveying, Levelling, and Drawing

(1) Fig. 2 shows surface contours, the depths of three bores to a lower seam, a point on the outcrop of an upper seam, and the site of a shaft. Assuming the strata to have a uniform gradient and thickness determine:—

(*a*) The rate and direction of full dip,

(*b*) the depth to the upper and lower seams in the shaft, and

(*c*) trace the outcrop of the upper seam.

(2) From the notes of an underground traverse, shown in Table 1, calculate the co-ordinates of the stations relative to Station A and the bearing and length of the line AD.

TABLE 1.

Line.	Bearing.	Horizontal distance (ft.).
AB	N. 23 deg. 40 min. W.	310
BC	N. 13 deg. 06 min. E.	215
CD	S. 80 deg. 36 min. E.	337

Another road starting from A has a bearing of N. 42 deg. 50 min. E. and CD is to be driven forward to intersect it at a point X. Calculate the distance DX.

(3) A mine roadway 20 ft. wide has vertical side walls 8 ft. high surmounted by a segmental arch 12 ft. high from the floor to the crown of the arch. Calculate the radius of the arch and the area of cross-section of the roadway.

(4) Explain, with the aid of sketches, the procedure in making an underground traverse with a theodolite indicating, (*a*) the marking and setting up at stations, (*b*) the targets used, (*c*) observing angles, and (*d*) measurement of distances, taking into account measurement in inclined roadways.

(5) The notes, shown in Table 2, are of an underground levelling made by measuring vertical angles with a theodolite sighting on to a levelling staff. Calculate the horizontal distances and the reduced level of the instrument axis and of Station B.

(6) In the course of sinking a shaft a large inflow of water has been met and the shaft has become flooded to a considerable depth. The shaft is 22 ft. 6 in. dia. inside the lining. A large sinking pump is put into operation and after 9½ hr. continuous running the amount of water recorded from the shaft is 273,600 gal. In the same time,

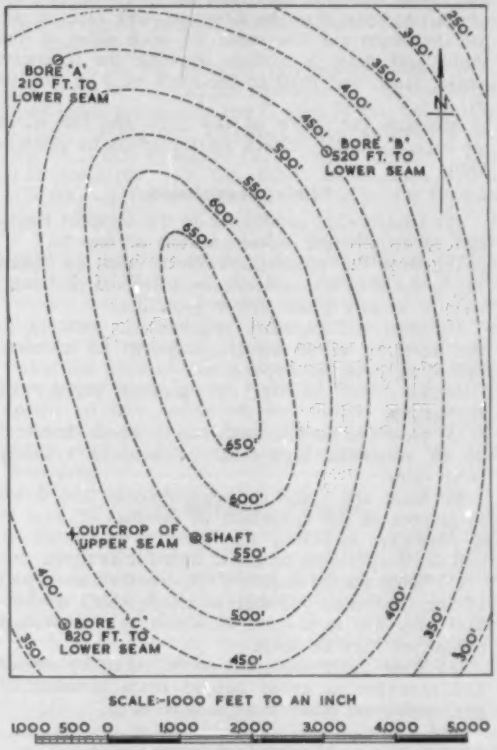


FIG. 2.—SURFACE CONTOURS, THE DEPTHS OF THREE BORES TO A LOWER SEAM, A POINT ON THE OUTCROP OF AN UPPER SEAM, AND THE SITE OF A SHAFT.

TABLE 2.

From	To	Inclined distance along line of collimation (ft.).	Vertical angles.	Staff readings (ft.).	Remarks.
Instr. Stn. A	Staff on BM	320	+ 5 deg. 36 min.	2.62	BM 8,561.42 ft. above an assumed datum.
Instr. Stn. A	Staff on Stn. B	398	+ 18 deg. 15 min.	4.00	Staff on Stn. B at top of drift.

the level of the water in the shaft has been lowered by 44.6 ft. Find, to the nearest gal./min. the amount of water flowing into the shaft.

(7) Sketch a modern dumpy level giving its essential features and show how its suitability for an important levelling may be tested.

(8) A roadway AB driven on the full rise of a seam, with gradient 1 in 8, meets a normal upthrow fault at B bearing at right-angles to the roadway and hading at 35 deg. from the vertical. A drift BC rising at 1 in 3 and driven on the line of the roadway produced intersects the seam at C, which is 360 ft. from B measured on the floor of the drift. Assume that the direction and rate of dip of the seam are the same on both sides of the fault and draw a section showing the roadway, seam, fault, and drift to the scale of 1 in. to 100 ft.

Measure the throw of the fault and the width of barren ground. Check your answers by calculation.

Mining Legislation

(1) Under what conditions do the Support Regulations require the systematic use of bars?

(2) State the precautions which must be taken in the event of an outbreak, or suspected outbreak, of fire at any place below ground.

(3) State the statutory requirements relating to the earthing of an electrical system of a mine, including portable apparatus.

(4) Describe, briefly, the general powers of Inspectors.

(5) Describe the circumstances in which detectors of an automatic type must be used in a safety lamp mine.

(6) State the statutory requirements laid down in respect of the collection of samples of dust in a roadway, including the method of sampling, and the preparation of the sample for analysis.

(7) What are the statutory requirements in respect of the maximum number of shots which a shotfirer may fire in a mine in which only permitted explosives may be used.

(8) State the precautions to be taken by owner and manager to avoid danger from inrushes of gas, water, or other fluid materials.

Mining Technology

(1) Considerable success has been achieved recently in the boring of large diameter boreholes underground. Describe briefly a method of boring such a hole of approximately 36 in. dia. Enumerate the purposes for which boreholes can be utilized. Discuss the limitations of the method.

(2) There have been a number of recent installations of multi-rope winders. In what circumstances would you favour the adoption of this type of winder?

(3) At a modern mechanized mine, workings in a level 5-ft. seam at a depth of 300 yd. are approaching a light engineering factory. The built-up zone occupies a circle of radius 150 yd. Discuss the consideration which would influence further development of workings in this area.

(4) Describe the operating principle of a cyclone separator and discuss its field of application in modern coal preparation practice.

(5) Discuss the transport problem involved in the supplying of materials from the surface to longwall faces. Describe, with the aid of sketches where required, how these difficulties may be overcome at a colliery using 3-ton capacity mine cars.

(6) What are the factors influencing the layering of firedamp in mineworkings? Describe the precautions which should be adopted to prevent the occurrence of this danger.

(7) A new district in an approximately level 4-ft. seam is to be developed for fully mechanized longwall working. Discuss the relative merits of the various systems of mechanization which could be adopted if the seam is:—(*a*) Primarily to be sold for carbonization, or (*b*) valuable as a house coal.

(8) A colliery working a gassy seam 4 ft. thick at a depth of 700 yd. has reserves in an area extending 1,000 yd. along the strike and 700 yd. to the rise, the seam being inclined at 1 in 3. The area is intersected by a series of faults approximately 200 yd. apart running parallel with the line of full dip of the seam and having displacements ranging from 3 ft. to 6 ft. Show with the aid of sketches how the workings would be laid out to produce 1,000 ton/day, and describe the method of working to be adopted.

(9) Enumerate the principal types of yielding support available for use in mine roadways. Discuss their relative merits and application.

CZECH COAL AND STEEL OUTPUTS UP

THE Czechoslovak coal industry produced 22,191,000 tons of hard coal and 40,727,000 tons of brown coal during the first nine months of 1960, representing increases of 5 per cent. and 6.9 per cent., respectively, on the output during the same period of 1959.

New pits are being sunk, of which four, with a daily output of 5,000 tons of high-quality coking coal, will be brought into operation in the Ostrava-Karvinna basin this year.

The metallurgical industry shows outputs, for the same period, of 3,488,000 tons of pig-iron and 5,027,000 of steel, the figures representing advances of 10.8 per cent. and 11 per cent., respectively, on the corresponding 1959 returns.

In the United States, as in other countries where the bulk of steel production is made in the open-hearth furnace, the advent of the various pneumatic processes has created a difficult situation demanding most careful consideration in deciding upon future policy. The choice in such cases lies between scrapping costly open-hearth plant in favour of one or other of the new processes, or seeking to apply modifications of pneumatic principles to increase the productivity of open-hearth furnaces. As pointed out by C. L. Kobrin, metallurgical editor of Iron Age, there have been lately a number of developments that should encourage open-hearth steelmakers.*

NEW LANCE MIXES FUEL AND OXYGEN

Open-hearth Output Raised

OXY-FUEL lancing to increase open-hearth productivity is undergoing trials at Ford Motor Company, River Rouge plant, Dearborn, Michigan. As an initial result, steel production rate there is said to be double that of standard open-hearth methods.

Developed by Air Products, Inc., Allentown, Pa., the lance drives heat into the furnace at a rapid rate, the reason for success being that it intensifies the mixing and burning of natural gas with oxygen to reduce the melt-down time. Then, the fuel is turned off and a high oxygen input rate is maintained to speed up refining. Temperatures up to 2,800 deg. C. can be obtained, as compared with about 1,870 deg. C. by standard open-hearth practice.

Installation of the lances presents no major problems. In most cases, it requires little or no modification of the existing furnace.

Cost of Oxygen Offset

Regarding costs, according to Air Products, the increased steel output and the savings in fuel should more than offset the cost of oxygen. The cost of lances, should be about $2,500 each. The outward appearance of the oxy-fuel lance is like the standard roof lance. It is water-cooled, about 6 in. dia., and composed mainly of carbon steel. The upper end of the lance, including the nozzle, which contains six ½-in. openings, is made of copper.

The mixing device is, of course, the main difference between the conventional and new type of lance. The oxygen-fuel mixture or straight oxygen supply, depending on whether the furnace is melting or refining, emerges from the nozzle at high velocities. It cuts through the slag and imparts heat directly to the metal.

The full impact of these lances has yet to be realized, and much development work remains to be completed. For example, each of the two lances used by Fords develops 30,000,000 Btu/hr., but lances capable of developing 60,000,000 Btu/hr. are being installed at a plant owned by the National Steel Corporation, Pittsburgh. Other lances of 100,000,000 Btu/hr. rating are now on the drawing boards.

As to the production rate, the open-hearth steelmaker is aiming for, the writer recalls that an open-hearth working without oxygen enrichment produces from 20 to 30 tons of steel/hr. A furnace equipped with a standard roof-lance turns out from 30 to 45 ton/hr. Compared with these figures the LD process produces from 85 to 100 tons of steel per hour.

A clue to the different production rates lies in the amount of oxygen consumed. Open-hearth roof-lance practice in the United States, before the advent of the new oxy-fuel lance, called for the use of 20,000 to 40,000 cu. ft./hr. of oxygen. The LD converter, on the other hand, uses about 150,000 cu. ft./hr. or more, depending on furnace size.

The current model of Air Products' new lance used by the Ford Motor Company has an oxygen capacity of 50,000 cu. ft./hr. And tests at Ford's works reveal that its open-hearth output of 60 to 100 tons of steel per hour approaches that of current LD practice. It is a matter of speculation what the open-hearth production rate will be when the larger lances at the National Steel Corporation plant go into operation, but output there is expected to attain at least 150 tons of steel per hour. The lance can also be used in the LD converter.

Evolutionary Progress

Development of the new lance is a natural step in the evolution of the open-hearth. Basic-brick roofs, which can withstand the high temperatures of the oxy-fuel lance, are already installed in many of the open-hearths in the US. Now, effort will have to be directed towards developing accessory equipment to handle the increased potential of a furnace.

More ladles and ingot moulds possibly of new design will be needed. Soaking pits will have to be larger and provision made to handle increased amounts of slag. Instruments will be needed for making rapid chemical analyses. Refractory manufacturers also have to keep pace with the

* Iron Age, July 28 1960.

higher temperatures generated by the new lance design.

One of the most important factors to be considered is that of charging. Ford's technique is to add molten metal immediately after the scrap and other solids have been charged and the doors banked. Its practice also calls for the substitution of burned lime for limestone to conserve heat. This technique is, in part, responsible for the high production rate. But when the new, higher-capacity lances are ready, production rates should be even greater, and new, faster-moving, charging machines will be required.

Finally, to meet the increasing needs for oxygen as a basic material in steelmaking, oxygen producers will have to build new plants of still greater capacity.

Pressure Vessel Research Towards Better Design

ARISING from a suggestion made by the British Welding Research Association, the Institution of Mechanical Engineers is arranging a symposium on "Pressure Vessel Research Towards Better Design." It will be held at the institution on January 18 and 19. The arrangements are being made by a committee appointed by the council, under the chairmanship of Mr. H. N. Pemberton. The procedure for the presentation and discussion of papers will follow normal institution procedure, the papers, about 12 in number, being divided into contributions dealing with components and experimental research, and those considering design and design codes. The various papers will include reports on stress analysis investigations, design and testing of various components, pulsating pressure tests, fatigue tests, comparisons of various codes, and probable future design requirements.

Concessional charges for registration and papers are available to members of the Institute of Refrigeration, the Institute of Welding, the Institution of Chemical Engineers, the Institution of Electrical Engineers, the Institution of Mechanical Engineers, and the Iron and Steel Institute. Registration forms, together with a list of papers to be presented, may be obtained on application to the secretary of the IME at 1, Birdcage Walk, Westminster, London, S.W.1.

Peterborough Conference on Clean Air Act

A conference on the Clean Air Act, arranged by the East Anglian Regional Advisory Council for Further Education in conjunction with the National Industrial Fuel Efficiency Service, will be held at the Peterborough Technical College, Eastfield Road, Peterborough, on Thursday, commencing at 2.30 p.m. Contributions will include "Industrial Requirements of the Clean Air Act," by Mr. G. A. Hiller, Chief Public Health Inspector, City of Leicester, and "Means of Complying with the Act," by Mr. T. F. Hurley, consultant, NIFES, lately chief research engineer, Fuel Research Station. Further details may be obtained from Mr. E. J. Tickner, area engineer, NIFES, 8, Queen Anne Terrace, Cambridge.

FORTHCOMING EVENTS

JANUARY 3

South Staffordshire and Warwickshire Institute of Mining Engineers:—Meeting at the Swan Hotel, Lichfield. Talk and two films ("Glass" and "Glass Making"), by Pilkington Bros., Limited.

JANUARY 4

Society of Chemical Industry (Corrosion Group):—Cathodic protection panel meeting at 14, Belgrave Square, London, S.W.1, at 6 p.m. Discussion on galvanic anodes.

Junior Institution of Engineers (Midland Section):—Meeting at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7 p.m. "Engineering in Chemical Works," by E. R. Brazier.

JANUARY 5

Midland Institute of Mining Engineers:—Meeting at the Royal Victoria Hotel, Sheffield. "Subsidence Observations over Shallow Workings, including Pneumatic Stowing and Rapid Advancing Faces," by W. J. Aynsley and G. Hewitt.

Institution of Mechanical Engineers (Industrial Administration and Engineering Production Group):—Meeting at 1, Birdcage Walk, Westminster, London, S.W.1, at 6 p.m. Discussion on "The Reliability of Mechanical Engineering Parts of Data Processing Equipment."

Institution of Mechanical Engineers (East Midlands Branch):—Meeting at the College of Technology and Commerce, Leicester, at 7.15 p.m. "The Vibration of Vertical Milling Machines under Test and Working Conditions," by Prof. S. A. Tobias.

JANUARY 6

Junior Institution of Engineers:—Meeting at Pepys House, 14, Rochester Row, Westminster, London, S.W.1, at 7 p.m. Films by Shell-Mex & B.P., Limited.

National Association of Colliery Managers

JANUARY 2

South Midland Branch:—Meeting at Ashby Rescue Station at 4 p.m. "Management Use of Method Study," by T. A. C. Williams.

JANUARY 10

Yorkshire Branch:—Meeting at the Miners' Welfare Hall, Brodsworth, at 3 p.m. "Whitwood Colliery Reconstruction," by J. Hilton.

South Wales Branch:—Meeting at the Castle Hotel, Neath, at 6 p.m. "Some Problems of Mechanization in the South-Western Division," by G. V. Standerline.

JANUARY 16

Midland Branch:—Meeting at 6.30 p.m. Address by J. Crawford, industrial relations member, NCB.

JANUARY 18

North of England Branch:—Meeting at the Mining Institute, Newcastle-upon-Tyne, at 6.45 p.m. "Problems of Roadway and Face Support in Steep Workings Adjacent to the Butterknowle Fault," by D. H. Fawcett.

JANUARY 25

Lancashire Branch:—Meeting in the Lecture Room, Manchester Literary and Philosophical Society, George Street, Manchester. "Record Speed Tunnelling in the Burnley Area," by M. Daniecki, Area tunnelling engineer.

JANUARY 26

South Staffordshire, Warwickshire, Worcestershire, and Shropshire Branch:—"Management Structure," by Mr. De Ville.

JANUARY 27

Kent Branch:—Meeting at the Swan Hotel, Deal, at 7.15 p.m. "Planning a Trolley Locomotive Scheme at Chislet Colliery," by T. E. Green, chief traction engineer, NCB, and L. Neal, planning engineer, South-Eastern Divisional Coal Board.

PRODUCTION OF COBALT in all forms in Canada totalled 1,649 tons in 1959, compared with 1,355 tons in 1958. No cobalt ore was mined in Canada during 1959. Production was obtained as a by-product of silver ore from the Cobalt-Gowganda area of Ontario, and from the smelting and refining of nickel-copper ores from the Sudbury area of Ontario and Lynn Lake area of Manitoba.

New Patents

PATENTS below are among the complete specifications accepted listed in the Official Journal (Patents). The numbers given are those under which the specifications have been printed and all subsequent proceedings will be taken.

Applications for copies of the full specifications (3s. 6d. each, post free) should be made to the Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C.2.

Mining and Mining Appliances

849,478 MAVOR & COULSON, LIMITED. Coal-cutters.

849,901 BRITISH THOMSON - HOUSTON COMPANY, LIMITED. Electrically operated winders, hoists, and the like.

849,902 BRITISH THOMSON - HOUSTON COMPANY, LIMITED. Control systems for electrically operated winders, hoists, and the like.

850,170 GEWERKSCHAFT EISENHÜTTE WESTFALIA. Advancing roof-support apparatus for winning operations in mining work.

849,450 ANDERSON, BOYES & COMPANY, LIMITED. Rotary cutter drums for mineral-mining machines.

849,681 SKIP COMPAGNIE G.M.B.H. Charging apparatus for use in mineshaft skipwinding installations.

849,698 HILL PORTER (NEWCASTLE), LIMITED, and TALBOTT. A. C. Struts and tie-rods for mine arches and the like.

849,424 OELLRICH, A. [trading as MASCHINENFABRIK UND EISENGIESSERIE A BEIEN]. Mechanized mineral winning and conveying mechanism.

849,963 GEWERKSCHAFT EISENHÜTTE WESTFALIA. Coal crusher arranged above a conveyor.

849,618 MINE SAFETY APPLIANCES COMPANY. Air filtering device.

850,324 SIEMENS-SCHUCKERTWERKE A.G. Surface-cooled electric machines for working underground.

850,201 SAARLANDISCHE G.M.B.H. FÜR GRUBENAUSBAU UND TECHNIK. Platforms for use in mine galleries or tunnels.

850,529 MINE SAFETY APPLIANCES COMPANY. Protective headgear and headgear lining.

850,677 UNION SIDERURGIQUE DU NORD DE LA FRANCE. Support members and applications thereof, in particular in mine framing.

851,238 EGGEMANN, W., and CAMPENHAUSEN, VON, E. [trading as SCHWARZ KOMM.-GES., H.]. Pillar supports for use in mines.

851,283 RHEINSTAHL WANHEIM G.M.B.H. Pitprops.

850,782 BARKER, R. E. Adjustable metal pitprops.

850,915 JOY-SULLIVAN, LIMITED, and BALL, C. F. Mineral-mining machines.

851,702 MILIK, R. Mining of minerals, particularly the mining of coal underground.

851,859 GUTEHOFFNUNGSHÜTTE STERKRADE A.G. Mine pitprops or like supporting devices.

851,419 GERLACH, K., and GERLACH, H. Pitprops.

852,032 EGGEMANN, W., and CAMPENHAUSEN VON, E. [trading as SCHWARZ KOMM.-GES., H.]. Mine and like supports.

851,766 GERLACH, K., and GERLACH, H. Hydraulic pitprop.

851,821 ATLAS COPCO A.B. Supporting and feeding apparatus for hammer drills, rotary drills, or coal picks.

851,669 ALLIMANN, G. Mechanical cutting device for machines used in mines, quarries, or work sites.

852,476 SKIP COMPAGNIE, G.M.B.H. Charging apparatus for skipwinding systems.

852,426 COOK, SONS & COMPANY (1930), LIMITED, J. Means for arresting over-running hoist cages.

852,080 BARKER & SON. ENGINEERS, LIMITED, W. H. Mine car tipplers.

852,168 BARKER & SON, ENGINEERS, LIMITED, W. H. Safety devices for use with pit cage winding machinery.

852,628 OELLRICH, A. [trading as MASCHINENFABRIK UND EISENGIESSEREI A. BEIEN]. Mechanized mining and conveying arrangement.

Metallurgy and Engineering

849,653 MITCHELL ENGINEERING GROUP, LIMITED. Wagon handling apparatus.

849,362 WELLMAN SMITH OWEN ENGINEERING CORPORATION, LIMITED. Apparatus for the casting of metal ingots.

849,918 RÖCHLING'SCHE EISEN- UND STAHLWERKE G.M.B.H. Killed converter steel which is ageing resistant and not embrittled when welded.

849,526 PYRENE COMPANY, LIMITED. Treatment of ferrous strip.

849,563 UNITED KINGDOM ATOMIC ENERGY AUTHORITY. Vacuum melting furnaces.

849,679 BRITISH ROPEWAY ENGINEERING COMPANY, LIMITED, and BUNCE, A. R. Material carriers for ropeways, cableways, telphers, and like overhead carrier systems.

849,687 CARPENTER STEEL COMPANY. Ingot mould.

849,781 MOY, P. C. D. Apparatus for emptying railway wagons of the end-door type.

849,534 INLAND STEEL COMPANY. Method of and apparatus for casting ferrous metals.

849,355 DEXION, LIMITED. Devices for cutting angle-section metal.

849,783 BRITISH OXYGEN RESEARCH & DEVELOPMENT, LIMITED. Manufacture of steel.

849,418 BRITISH IRON AND STEEL RESEARCH ASSOCIATION, and MORTON, J. S. Continuous casting of metals.

849,702 ARMCO INTERNATIONAL CORPORATION. Precipitation hardenable steel.

850,141 SOC. D'ELECTRO-CHIMIE, D'ELECTRO-METALLURGIE ET DES ACIERIES ELECTRIQUES D'UGINE. Production of ingots.

850,511 LOEWY ENGINEERING COMPANY, LIMITED. Method of rolling and apparatus for controlling the rolling of sheets to a tapered thickness.

850,314 MANNESMANN A.G. Manufacture of pouring heads for ingot moulds.

850,607 UNITED STATES STEEL CORPORATION. Method and apparatus employing induction heating for welding plate edges, such as the plate edges of a seam cleft in a formed metal pipe blank.

850,609 INSTITUT DE RECHERCHES DE LA SIDERURGIE. Method of blowing pulverized materials into a converter and apparatus for carrying out said method.

850,625 ALLIANCE MACHINE COMPANY. Apparatus for stripping ingots and the like.

850,451 PHILIPS GLOEILAMPENFABRIEKEN N.V. Methods of manufacturing hardenable steel strip.

850,709 FORGES ET ACIERIES DE DILLING S.A. Open cooling boxes of metallurgical furnaces, especially of blast furnaces.
850,675 METALLGESELLSCHAFT A.G. Multiple hearth furnaces and methods of operating the same.
850,730 UDDEHOLMS A.B. Method of making alloy steel articles and the alloy steel articles made thereby.
850,937 SANDVIKENS JERNVERKS A.B. Device for the continuous measurement of the thickness of a strip.
851,228 INSTITUT DE RECHERCHES DE LA SIDERURGIE. Blast boxes for converters.
851,066 GENERAL ELECTRIC COMPANY. Grain-oriented sheet metal.
851,282 DAUSSAN, H. J. Device for providing a dead head in an ingot and like mould and apparatus for using said device.
851,454 FERRERSAND AGGREGATES, LIMITED. Production of iron ore.
852,045 BOT BRASSERT OXYGEN TECHNIK A.G. Blast tubes for refining crude iron.
851,750 FISCHER, A.G., G. Recuperators for preheating the blast of shaft furnaces.
852,050 CONVEYING DEVELOPMENTS, LIMITED. Idler set for use with endless belt conveyors.
851,620 UNITED STATES STEEL CORPORATION. Method of coating metal sheets with synthetic plastics.
851,948 BABCOCK & WILCOX COMPANY. Method of hot working a metal billet.
851,664 KLÖCKNER-HUMBOLDT-DEUTZ A.G. Roller briquetting press for briquetting ore, coal, or similar material.
851,435 KLÖCKNER-HUMBODLT-DEUTZ A.G. Roller briquetting press.
852,060 SOC BERTIN & CIE. Auxiliary blowing apparatus in a melting or treatment furnace.
851,949 BABCOCK & WILCOX COMPANY. Apparatus for extruding a metal billet.
852,632 BOYD & COMPANY (ENGINEERS), LIMITED, J. Device for moving railway wagons and a weighbridge traverser incorporating such a device.
852,630 YAWATA IRON & STEEL COMPANY, LIMITED. Process for treating steel for preventing surface defects thereof.
852,258 HENNIG, W. Rolling mills.
852,424 DORTMUND-HÖRDER HÜTTENUNION A.G. Methods of desulphurizing pig-iron and cast-iron melts.
852,078 INSTITUT DE RECHERCHES DE LA SIDERURGIE. Tuyeres for blast furnaces.
852,373 STORA KOPPARBERGS BERGSLAGS A. B. Method of refining silicon-containing pig-iron with oxygen in a rotary furnace.
852,265 BRITISH IRON AND STEEL RESEARCH ASSOCIATION. Iron and ferrous alloys.
852,142 FOUNDRY SERVICES INTERNATIONAL, LIMITED. Treatment of steel in the manufacture thereof.
852,143 CENTRE TECHNIQUE DES INDUSTRIES DE LA FONDEREI. Method of producing a metal or alloy article.
852,441 AMERICAN SMELTING & REFINING COMPANY. Method of operating a blast furnace.
852,443 UNITED STATES STEEL CORPORATION. Fluidized-bed reduction of ore.
852,500 RUHRSTAHL A.G. Blast furnaces.
852,710 KOLFLAATH, J. A. Refining of silicon in a ferro-silicon material.
852,719 METALLGESELLSCHAFT A.G. Sintering of ores.

Fuel Treatment and Utilization

850,163 WOODALL-DUCKHAM CONSTRUCTION COMPANY, LIMITED. Production of gas.
849,414 KOGYO GIJUTSU-IN. Method of producing carbon articles solely from caking coal or coking coal as a raw material.
849,987 ALLIED CHEMICAL CORPORATION. Process for treating coke-oven tar.
851,206 TEXACO DEVELOPMENT CORPORATION. Coal gasification apparatus.
851,901 STEINMÜLLER G.M.B.H., L. & C. Method for the extraction of gas from fuels.
851,443 METALLGESELLSCHAFT A.G. Method of treating gases derived from the distillation of coal.
852,058 SAARBERGWERKE A.G. Apparatus for use in coal washing tanks.
852,121 STAMICARBON N.V. Method of and apparatus for separating pieces of solid material according to specific gravity.

Expansion of Output at Swedish Steelworks

AN ambitious scheme in the rapidly expanding Swedish steel industry is that embarked on by the Domnarvet steelworks, belonging to the Stora group. The first stage of the expansion scheme at these works, which has already been completed, has increased its annual capacity to 400,000 tons of rolled steel and steel castings; the second stage will add a further 100,000 tons to that capacity by the end of this year, and eventually it will reach a figure of 700,000 tons of finished steel.

The most recent addition to the equipment is a second 100-ton electric steel furnace, which was put into production in August, since when there has been installed a twin heavy plate rolling mill with a roll diameter twice that of the previous unit and the rail mill has been modernized and adjusted for the production of rails 40 m. (132 ft.) long.

Of particular interest is the introduction of a new method of producing rolled steel which has been described in detail in the company's house organ Bergslaget, in an article by Mr. Sixten Wohlfahrt, head of Domnarvet. This method involves the abandonment of the old one, of hot-rolling sheets from steel bars, in favour of cold-rolling from hot-rolled broad strips up to 1,650 mm. (65 in.) in width. The ingots, which have a standard weight of 17 tons, will be rolled into slabs in a new reversible four-high rolling mill, the slabs then being rolled into heavy plate, medium plate, or wide strips, as required.

Further plans include the replacement of the basic-Bessemer plant by two 100-ton Kaldo converters. With these Domnarvet will have capacity for the production of 1,000,000 tons of ingots a year. The entire productive capacity is planned for high flexibility, with a view to achieving the utmost adaptability to changing market conditions.

IRON AND STEEL TRADE

HOLIDAY closures are bound to have affected outputs of finished and semi-finished steel products from the rolling mills, but there is no doubt that the totals for December will be well in line with the high levels achieved in the previous two months of the last quarter of the year. Pressure on the finishing trades has eased slightly and no break in the continuous processes at steelworks and blast furnaces should lead to a greater availability of crude steel. It will certainly be needed to meet the heavy demands weighing down the order-books for the first three months of 1961.

Pig-iron

Resumption of work at the ironfoundries has presented little or no change on pre-Christmas levels, but business is not so active as it was 12 months ago. The supply of pig-iron in all grades is plentiful and the foundries have little difficulty in covering their requirements.

The low phosphorus irons used in the production of high-duty castings continue, comparatively, in greatest demand, and hematite and refined irons are also delivered to requirements. There is plenty of high phosphorus iron available both for home consumption and export.

Semi-finished Steel

Well-filled order-books marked the resumption of work for the re-rollers and the majority have sufficient business on hand to enable them to maintain satisfactory outputs. There is some slack to be taken up on the part of those whose business is principally with the motor-car industry.

Most of the mills are satisfactorily supplied with mild steel semis as apart from stocks on hand steelworks continue to send forward substantial tonnages in this grade.

Finished Steel

The demand for all classes of finished steel is likely to be back to normal by this week-end and, wherever possible, production is being stepped up to meet customers' requirements. New business must be on an extended delivery basis as current obligations cover some months ahead. Sufficient reinforcing rods, small flats, rounds, and squares are hard to come by, but there is a definite easing in the call for cold reduced sheets.

With capacity available in current and forward programmes, additional tonnage can still be accepted for black sheets and hot rolled strip and brisker business would be appreciated by the makers of light rails, pitprops, arches, etc.

WEST CANADIAN COLLIERIES, LIMITED—In reply to last month's circular from Mr. S. E. Scammell asking shareholders to convene an extraordinary meeting to remove at least six directors and appoint five new ones, Mr. E. H. Bernard, chairman, says that major changes would be undesirable before negotiations regarding coal assets have been completed. The board has not decided against recommending some substantial distribution to holders, but a decision is not possible until the future of coal assets is determined, he states. In last month's circular, Mr. Scammell said the proposed new directors would undertake to make an annual distribution of 2s. per share, tax free.

£28,000,000 Investment Plan for Dutch Steel

HOLLAND'S only major iron and steel manufacturers, N.V. Royal Dutch Blast Furnaces (Hoogovens), has announced a three-year investment programme to cost more than Fls. 300,000,000 (£28,300,000). This follows the recent disclosure last week that a commission set up by Hoogovens, the State Mines, and the Netherlands Cable Company, had advised against the establishment of steel manufacturing capacity in Rotterdam. The Hoogovens programme includes a new rolling mill which will be able to turn out blooms as well as sheet steel.

The programme is connected with plans announced earlier this year, which referred to an extension of raw steel production capacity to nearly 3,000,000 tons in 1962, compared with 1,400,000 tons actual production in 1959. These plans, however, left a gap between capacity and actual output—the latter being estimated at only 1,900,000 tons by 1962.

This gap would have been caused by a lack of ancillary installations, some of which will be provided by the new programme. As a result, actual raw steel output in 1962 is now expected to reach 2,450,000 tons.

700 Suspended by SCOW for Taking Extra Day Off

BETWEEN 700 and 800 workmen employed at the Abbey Works melting shop of the Steel Company of Wales, Limited, at Margam (Glam), have been suspended by the company until Sunday for taking an extra day off at Christmas in addition to the three days off provided for under an agreement. Production at the shop has been stopped as a result of the suspensions, but production at the works has continued as normal since the company's other melting shops are not affected.

The company said on Wednesday that its manual workers are entitled to 18 days' holiday a year under agreements with the Iron and Steel Trades Confederation and four of them are normally taken at Christmas, but this year the union agreed that the Christmas break should be only three days—from Saturday to Monday.

The rest of the 12,000 men at the Abbey Works observed the agreement, but the 700-800 stayed away on Tuesday, having previously warned of their intention to do so on the ground that the agreement had been drawn up between the company and the union without reference to the union's rank and file.

Coalfield News

Scots Miner Defends British Youth

MEMBERS of the "Flog 'em Brigade" came under the lash at the Scottish miners' annual youth conference in Edinburgh last week. "It is high time these people realized that the youth of today is as good, if not better than, the youth of their time," Mr. Robert Whiteside (23), chairman of the Scottish Miners' Youth Committee, told the conference.

The "Angry Young Men," he said, were justified in expressing their anger, particularly about unemployment. In Scotland in October, 1,820 boys and 1,111 girls were out of work. On leaving school many young people were forced to accept dead-end jobs. Mr. Abe Moffat, secretary of the Scottish Area of the National Union of Mineworkers, said it was not surprising to find a lack of confidence developing among miners. Of the 8,000 miners who would leave the industry next year, more than 50 per cent. would be under 31.

A TOTAL OF NEARLY £102,000 was recorded immediately before Christmas by the Six Bells Colliery Disaster Fund.

WORK ON THE installation of oil heating in a new grammar school at Coalville (Leics) has been suspended following protests from local miners.

ONE OF County Durham's old coke plants, Langley Park cokeworks is to close not later than April 30, 1961. All the 150 men employed there will be found alternative work.

ARLEY, near Coventry, branch of the National Association of Overmen, Deputies, and Shotfirers, has elected Mr. D. Willis, chairman, and Mr. J. D. Stewart, secretary and delegate.

FOUR MINERS were injured last week when three runaway man-riding mine cars careered nearly half-a-mile underground at Rothwell Colliery, near Leeds, and crashed into a diesel locomotive.

DEPUTY AT Fallin Colliery, Stirling, for the past 35 years, Mr. Daniel Roy has retired. Born in the district, he began work in the pits 50 years ago at Millhall Colliery and 10 years later went to Fallin.

OVERALL PRODUCTIVITY in the Durham Division of the National Coal Board during the first 49 weeks of the year averaged 22.10 cwt. per manshift, against 21.45 cwt. in the corresponding period of 1959. At the face, productivity averaged 64.63 cwt. per manshift, compared with 62.80 cwt. in 1959.

PNEUMATIC STEMMER has been withdrawn from use throughout the Durham Divisional Coal Board, following an accident at Westoe Colliery, in which a miner was killed. An inquiry is being held by the board into the accident and the device will not be used in the pits at least until the full report has been made.

CHRISTMAS PAY-ROLL of £2,300, made up of 180 wage packets, was stolen from the general office safe of Mary Colliery (Fifeshire) last Friday. The money had been locked in the safe at 5 p.m. the previous day ready for paying the wages of the backshift men. Police found no sign that the safe or office door had been forced.

SHORTAGE OF MANPOWER might cause the National Coal Board to revise its policy of compulsory retirement at 65 and to offer certain men capable of doing a useful job the option of carrying on work after 65. This was suggested by Mr. S. Schofield, compensation agent of the Yorkshire Area of the National Union of Mineworkers, at the annual treat for veterans of Monckton No. 3 and 4 Colliery (Yorks).

FIRE WHICH BURNED for five days last week at Argyll Colliery, near Campbeltown, has been put out. Miners cleared passages of gas to resume production on Monday. A pit official said that the older workings, where the fire occurred, would be permanently flooded to prevent a further outbreak. There have been three fires in this section within the past two years.

UNDERGROUND WORKERS at the £8,000,000 Cwm Colliery project, near Pontypridd, have been invited by the South Western Divisional Coal Board to compete with private firms by tendering for tunnelling work. If they submit a competitive tender they will get the work. It is an extension of the existing contract system among pit pieceworkers for underground drivage work.

PROBLEM CREATED by the re-organization of mines in the North-Eastern Divisional Coal Board area was that of transporting miners to work, it was stated at a meeting of the Northern Area Traffic Commissioners in Newcastle-upon-Tyne last week, when Mr. Norman O'Hara was granted exclusive rights to transport miners between Bishop Auckland, Binchester Blocks, Spennymoor, and Chilton Colliery.

PRODUCTION at Auchincruive 1/2/3 Colliery, Mossblown (Ayrshire), stopped today (Friday). Closure of the pit, due to exhaustion of reserves of workable coal, has coincided with the phased development of Killoch Colliery, Ochiltree, and most of the men at Mossblown will be employed at Killoch. Auchincruive has been worked for over 60 years, and the greatest daily output was about 1,700 tons in 1940.

The Old and New in Mining Review

NEW YEAR issue of Mining Review, the National Coal Board's newsreel, typifies the spirit of ringing out the old and ringing in the new in the coal industry. At a time when many coalfields are facing a labour shortage the new is personified in a 21-year-old management trainee in Somerset—Mr. Nigel Booth, who is working for his manager's certificate at Writhlington Colliery. This brief glimpse of the technical and scientific skill required in modern mining should dispel many doubts in the minds of prospective recruits.

Not only new men, but new machines are coming into the industry and the Review takes a last look at the old winding engine at Wearmouth Colliery (Co. Durham), which is soon to be replaced. The engine has been working at the pit since 1868 and judging by the care with which its operators maintain it, they at least will regret its passing.

Mr. Ted Haynes is unique among chimney sweeps—he is the only one in Britain who is nationalized. Because of the lack of sweeps, the North-Western Divisional Coal Board started its own service and now Mr. Hayes is booked up for months ahead. If the service continues in popularity, the Board intends to extend it.

The January issue of the Review ends with a roar—that of the crowd at the rugby union match for the Yorkshire Cup. Two of the members of Wakefield Trinity, the winners, are miners at Sharleston Colliery and two more work at Crigglestone Colliery. After watching the rugby-playing miners in training the film ends with some exciting moments from the game which Wakefield Trinity won from Huddersfield, 16 points to 10.

THE COAL TRADE

DEPLETION of colliery ground stock is expected in several parts of the country to give rise to difficulty in replenishing merchants' stocks and delivery delays to the consumers. It is reported that the time-lag in fulfilling orders for some of the well-known manufactured fuels is now about four weeks, with little prospect of any alleviation in the New Year. The recession in the car industry has been felt in the Midlands in the call for industrial fuels, but it has not been sufficient to result in any appreciable falling-off in the overall demand.

DURHAM AND NORTHUMBERLAND

The market had a busy pre-holiday period with a sustained demand in the household section which was heaviest for processed and named smokeless fuels. On the current supply outlook, it does not seem that this will be met adequately this winter. Household cokes cover requirements without much difficulty though as an alternative to named smokeless classes they do not seem to have the same attraction for consumers.

Durham coking coal and industrial cokes are all steadily taken up and there is average trade for Durham gas coal. In the export section, quite a useful volume of business has been done over the first quarter of the year. Taking the shipping places of the North-East Coast as a whole, coastwise trade has shown fluctuations in terms of shipments.

SOUTH WALES

Swansea—Demand in the domestic sector of the trade maintains the recent high levels. The difficulties at the collieries have been overcome and there is a considerable improvement in colliery supplies to merchants whose waiting lists are reasonable for the time of the year. With the exception of best anthracite boiler nuts, most grades of coal can be had after a not too long delivery delay.

The central heating market is now in its peak period and the dry steam cobbles and anthracite beans and grains favoured by consumers are fully sold and although, for the moment, there is not any real shortage, merchants are not too happy about the immediate future.

The industrial sector continues to take capacity bookings. The backlog caused by the recent floods is not proving too serious in the industrial market and the majority of consumers are well stocked.

DERBYSHIRE

Pressure for supplies of domestic coals is easier as most people's requirements were met in time for the start of the holiday. However most merchants have a fair number of orders on hand, and forwardings are very limited owing to the slow restart at many pits. Best and hand-picked are in fair request and very little is coming to hand. The better types of screened cobbles and brights are popular, but only moderate forwardings are in evidence. Cheaper brights are sought after but supplies are limited. Best large nuts attract a fair amount of attention and most inquiries can be met. Washed medium nuts are in firm request and all available tonnages are being taken up. Washed doubles attract a limited inquiry, and orders are cleared without difficulty.

Demand for domestic coke nuts is brisk, with a considerable overlap of orders from last week requiring urgent attention. Deliveries are continuing at full pressure. Domestic anthracite remains very tight, and Phurnacite is now becoming much more difficult to obtain than for some considerable period. Small anthracite is also appreciably tighter, and some distributors find it more difficult to maintain satisfactory deliveries.

The market in industrial coals continues to be firm and supplies are rather slower as the pits settle down after the holiday break. Nutty slacks are fairly prompt and dry screened nuts are keenly sought and all available tonnages are eagerly accepted. Hard steams are in fair request, and supplies are fair. Washed coals are in considerable demand, with rail transit delays not uncommon, and the waiting time at local colliery landsales is building up somewhat. There is a fair demand for all grades of hard and gas coke and on the whole despatches are quite prompt.

Nottinghamshire Miners Criticize Minister of Power

CRITICISMS that Mr. Richard Wood, Minister of Power, in a reply to a memorandum from the National Union of Mineworkers, appeared to be "disregarding" the social consequences of contraction in the mining industry and that the Minister when asked for definite targets had "given no indication" that they were forthcoming, were made by Mr. Jack Tighe, Nottingham Area NUM president, and Mr. Albert Martin, Area secretary, at a meeting of the Nottinghamshire Miners' Council.

Nor had the Minister given clear replies to questions on the balance of payments, the estimated energy consumption in 1965, and what the balance would be between coal, oil, nuclear power, and hydro-electric power.

Still No Recognition for "Rebel" Deputies

MEMBERS of the Amalgamated Central Association of Colliery Overmen, Deputies, and Shotfirers, who are seeking recognition of their "rebel" union, were told at Chesterfield last weekend that the TUC has rejected an approach to become affiliated. The TUC considers that the ACA should first heal the alleged breach with the parent union, the National Association of Colliery Overmen, Deputies, and Shotfirers, before a further application for affiliation is submitted.

Explaining some of the aims of the ACA, Mr. Tom Houghton, a member of the executive committee, said: "We want a man to be free to join the trade union of his choice and to that end we shall continue to fight."

Personal

Mr. W. E. Jones Chairman of Board for Industry

NEW chairman of the Southern Regional Board for Industry is Mr. W. E. JONES. His appointment takes effect from January 1, 1961 and follows the death in October, of Sir Luke Fawcett, who was chairman from July, 1952.

Mr. Jones was, until recently, president of the National Union of Mineworkers, and a member of the General Council of the Trades Union Congress. He is also a past secretary of the Miners' International Federation.

Mr. J. E. HOLGATE, metallurgical consultant of Dinas Powis, near Cardiff, who has been engaged by certain business interests to carry out special investigations in East Africa, left by air on Wednesday.

Director of Head, Wrightson & Company, Limited, and the Westinghouse Brake & Signal Company, Limited, Mr. GORDON W. H. RICHARDSON has been appointed to the board of Lloyds Bank, Limited.

General manager of Heeley Rolling Mills, Limited, Sheffield, since 1928 and a director for the past three years, Mr. A. O. WALL retired last Friday. He received a presentation from Mr. F. J. CHANTRY who has succeeded him.

Managing director of Alcan Industries, Limited, Mr. S. E. CLOTWORTHY, has been elected chairman of the Aluminium Industry Council in succession to Mr. H. G. Herrington, managing director of High Duty Alloys, Limited.

Mr. T. S. NICOL, of Whitley Bay, is retiring from his position as secretary of the North-East Coast Institution of Engineers and Shipbuilders, Newcastle-upon-Tyne. He became connected with the organization 48 years ago, and was appointed secretary in 1939.

After 46 years' service with Drysdale & Company, Limited, pump manufacturers, of Glasgow, Mr. T. L. MACKIE, the sales director, is to retire tomorrow (Saturday). He will continue to serve the company, a subsidiary of G. & J. Weir Holdings, Limited, in a consultative capacity.

Newcastle division of Durham University has appointed Dr. R. N. PARKINS as Reader in Metallurgy, and Dr. J. D. THORNTON as Reader in Chemical Engineering. A second Chair of Geology and a professorship in applied mechanics are to be established in the mechanical engineering department.

Secretary of the Durham Miners' Association, Mr. SAM WATSON, has been made a governor of the English-Speaking Union with which he was prominently associated in the series of week-end study courses which its current affairs unit has helped to arrange during the past three years at Lambton Castle.

Santa Claus at the annual party of Arthur Balfour & Company, Limited, Sheffield, looked suspiciously like Mr. W. H. PERKINS, former works manager—but then he has for the past 30 years to over 9,000 children. Mr. Perkins is 73 and he worked for the company for 40 years before his retirement.

Director of Ruston & Hornsby, Limited, Mr. R. C. SHEPHERD has been appointed president of the Engineering and Allied Employers' (Lincoln and District) Association. The senior vice-president is Mr. H. M. H. FOX, joint managing director of Smith Clayton Forge, Limited, and the junior vice-president is Mr. J. H. PAGE, technical director of Ruston & Hornsby.

Board Changes at Beyer Peacock

NEW YEAR sees a number of changes in the boards of the companies in the Beyer, Peacock & Company, Limited, group of engineers and founders. Mr. James Hadfield is to succeed Mr. Harold Wilmot as managing director of the holding company, chairman of Beyer, Peacock, Gorton, Limited, and managing director of Richard Garrett Engineering Works, Limited. Mr Wilmot will remain chairman of the holding company and for the time being of Richard Garrett and the Anti-Attrition Metal Company, Limited.

Mr. M. A. Crane and Mr. H. G. Kennedy are to join the board of Beyer, Peacock, Gorton—Mr. Kennedy retiring from the board of Richard Garrett Engineering together with Mr. J. A. T. Barstow who is to become a director of both Denings of Chard, Limited, and Brecknell, Willis & Company. Limited. Mr. R. J. Hadfield and Mr. E. Cuthbert have been appointed to the board of Richard Garrett.

Associated Engineering's £12,500,000 Programme

LARGE programme of capital expenditure is the manifestation of the optimism felt by the directors about long-term prospects of Associated Engineering, Limited, group. In his annual review, the chairman, Mr. H. R. Moore, states that the total programme of over £12,500,000 is formidable, but the board is confident in the group's ability to meet it.

Main projects in this country are for a new foundry and piston ring plant at Sunderland, a new plant at Lydney for the British Piston Ring Company, Limited, and for considerable extensions at Wellworthy, Limited, for diesel engine products. The total cost will be some £3,750,000, when in full production.

Major oversea proposals are for a new foundry and machine shop in Italy and for consolidation in a new factory in South Africa. Present estimates of the two schemes is about £1,750,000. The group's initial investment in France amounts to £805,000.

Murex Increases Interim Dividend

AN interim dividend of 5 per cent. for the year to April 30, 1961, is being paid by Murex, Limited, metallurgists, of Rainham (Essex), on £3,850,000 capital as increased by a three-for-four scrip issue. This compares with last year's equivalent $4\frac{2}{7}$ per cent. and, the directors state, should not be taken as indicating any material increase in the total distribution for the current year. Present indications are that the group trading results for the year will compare favourably with those of preceding years.

The demand for metallurgical products was maintained at the high level achieved in the latter half of the previous year and selling prices remained substantially unchanged. Murex (Australasia) Pty., in which Murex Welding Processes has a 50 per cent. holding, had a successful year to June 30 last and the dividend was again increased.

NEWS IN BRIEF

CHESTERFIELD BOROUGH COUNCIL has approved plans for a new factory in Chesterfield for the Alloy Steel & Iron Company.

STAFF TRAINING COLLEGE is to be opened next month by the British Oxygen Company, Limited, at Chartridge Lodge, near Chesham (Bucks).

AUSTRALIAN SUBSIDIARY has been formed by Brown Boveri Swiss Engineering. Called Boveri Australia Proprietary, Limited, its head office is in Sydney.

LONGEST-SERVING employee of Albion Drop Forgings, Limited, Coventry, Mr. Oliver Rees (70), retired last Friday after 57 years with the company.

PRELIMINARY PLANS are being considered by Norway's State-owned aluminium concern, A/S Ardal and Sunndal Verk, for a new smelter with an output capacity of 100,000 tons annually.

BECAUSE of the decline in the coal trade on the Tyne, the Howdon Staith, near North Shields, is to be closed on December 31, 1960. It is the second staith to be closed at the port this year.

NEW £150,000 works is to be built at Smethwick (Staffs) by the United Spring Company, Limited, spring manufacturers, of Smethwick. It will be the first new factory in the town for 20 years.

THE Plessey Company, Limited, is to distribute more than £55,400 in long-service bonuses to some 3,250 hourly-paid employees with over five years service, including more than 250 who have been with the company for over 20 years.

INTEREST in the Australian company M. B. John & Hattersley, Limited, valve makers of Ballarat (Victoria), in which Hattersley (Ormskirk), Limited, is interested, is to be bought by the Crane Company, valve makers, of Chicago, US.

IT WAS STATED in error in our issue of December 9 that the pig-casting machine, part of the plant supplied by Head, Wrightson & Company, Limited, for the Spanish State steelworks at Aviles, had produced an average of 14,000 tons a day. The figure should have been 1,400 tons.

NEARLY 300 miles of ship wiring cables for use in Oriana—more than enough to provide a direct cable link between London and the Scilly Isles—has been supplied by British Insulated Callender's Cables, Limited. It also supplied all the copper section for the busbar installation.

TWENTY SIX EMPLOYEES of Talbot Stead Tube Company, Limited, Walsall, each with 25 years' service, were each presented with a gold watch last week, by joint managing directors, Mr. P. Grove and Mr. A. B. Innes Dick. To mark his 50 years' service, Mr. Sydney Marriott received premium bonds.

ALTHOUGH UNABLE to pay the usual Christmas bonus of a full week's pay, Herbert Morris, Limited, cranemakers, of Loughborough, paid a bonus on a reduced scale "thanks to an appreciable increase in orders coming in." Three weeks ago employees were told that it would be impossible to pay the usual bonus.

PERSONAL GIFT of 5s. shares to more than 400 workers, and retired workers, of Jones & Shipman, Limited, machine-tool manufacturers, of Leicester, was announced by Mr. T. S. Shipman, managing director, last week. The number of shares each worker will receive depends on the length of service over 10 years.

ONE OF THE LEADING French steel producing companies, Usinor, has floated a NF 50,000,000 debenture loan. It will finance the company's Dunkirk steel complex which, it is claimed, will produce more than 1,000,000 tons of steel by 1963. Investments required for the project total NF 1,000 a ton, the company claims.

TALLEST CHIMNEY in Sheffield, erected in 1853, at the works of steel manufacturers Samuel Osborne & Company, Limited, is to be demolished brick by brick. It is 184 ft. high, weighs 749 tons, and cost £320 to build. The chimney was originally built for the steam-driven forge hammer, but compressed air is now used.

HIGH AUTHORITY of the European Coal and Steel Community has authorized Thyssenhütte to take up provisionally an option to acquire a holding one share short of 50 per cent. in Stahl und Walzwerke Rasselstein, a leading German producer of tin plate. At present 75 per cent. of the shares are held by the Otto Wolff group.

WORK IS TO BEGIN early next year on the building of foundations to carry a mammoth set of scrap steel-cutting shears at the Faslane (Dunbartonshire) yard of Shipbreaking Industries, Limited. The largest of its kind to be installed in Britain, the shears are being supplied by Lindemann of Düsseldorf and are expected to be operating by the spring.

DREDGES and dredging machinery of Ellicott design will be manufactured in England by Stothert & Pitt, Limited, of Bath, under an agreement entered into with Ellicott Machine Corporation, of Baltimore, USA. Ellicott will in future be represented in a sales capacity in the UK by John Blackwood Hodge & Company, Limited, London and Northampton.

THREE-DAY COURSES on fuel oil-firing are to be held by the National Industrial Fuel Efficiency Service, at Ailsa House, Kings Road, Reading, during January, March, May, June, September, November, and December, 1961. The courses are designed to meet the needs of industrial plant engineers, heating engineers, and supervisory staff responsible for oil-fired boiler plant.

ARRANGEMENT has been agreed between the British Anthracite Company, Limited, and Michael & Partners, Limited, for the exchange of services and close liaison in regard to their respective functions in coal distribution and allied activities. Mr. H. M. L. Berresford, managing director of Michael & Partners, terminated his full-time services with British Anthracite on November 30, 1960.

TECHNICAL ADVISER to the British Iron and Steel Federation, Dr. Colclough, is arriving in New Delhi on Wednesday to complete technical discussions on the expansion of the Durgapur steel plant. Another member of the Federation, Mr. Bury, is arriving in India on Sunday to discuss long-term arrangements for the employment of British personnel needed for working the plant.

LEEDS UNIVERSITY has acknowledged the following gifts:—£1,842 for the Department of Physical Chemistry from the Department of Scientific and Industrial Research, for research on the metastable states of argon; £1,375 for the Department of Mechanical Engineering from the DSIR, for research on elasto-hydro-dynamic problems; £3,850 for the Department of Metallurgy from the UK Atomic Energy Authority, for research on pure and commercial uranium; £1,000 for the Department of Mining from Richard Sutcliffe, Limited.

Company News

CERAMIC HOLDINGS, LIMITED—Sales have been maintained at a higher level than last year and it is expected that the total profits for the full year to March 31, 1961, will show some improvement over last year. No interim dividend is to be paid (same).

ALENCO, LIMITED—For a consideration of £1,000,000 the company, which is controlled by Charterhouse Industrial Holdings Company, Limited, has bought Ermeto, SA, of Paris, the French counterpart of British Ermeto Corporation, Limited, which is one of the company's UK subsidiaries.

METAL BOX COMPANY, LIMITED—The one-for-six rights issue to raise £10,300,000 foreshadowed recently will be made to ordinary stockholders registered on November 25 at 57s. 6d. a £1 share. The first payment of 30s. a share will be due on acceptance by January 27, and the balance of 27s. 6d. by February 24.

ASSOCIATED COMMERCIAL VEHICLES, LIMITED—Creation of 2,200,000 £1 ordinary shares will be proposed at an extra-ordinary meeting on January 21, 1961. The company, as already stated, is making a rights issue of 2,087,500 £1 shares at 30s. each on a basis of one for every share held on December 28, 1960.

H. W. KEARNS & COMPANY, LIMITED, machine-tool manufacturers, of Altrincham—Orders are coming in freely, there is a lot of business about, and prospects are encouraging, states the chairman, Sir Lionel Kearns. The company is planning a new office block and alterations to the works which will enable production to be increased.

BRUCE PEEBLES & COMPANY, LIMITED, manufacturing electrical engineers, of Edinburgh—Shareholders are informed that delays in the new plant which is still not available will seriously affect the current year's results and it is unlikely that a dividend will be recommended on the ordinary shares, compared with 10 per cent. for 1959.

LANCASHIRE STEEL CORPORATION, LIMITED—Final dividend of 7½ per cent. makes 11 per cent. for the year ended October 1, 1960—an increase of 2½ per cent. over the previous effective rate. Group profits were £4,425,713 for the year, compared with £3,873,440 for the 53-week period of 1958-59, before tax of £2,290,000 (£1,950,000). The profit balance is £2,135,713 (£1,923,440).

WEIR VALVES, LIMITED—An issue of shares has been made to Pacific Valves, Inc., of California, and the company is to manufacture and sell the US company's products in all world markets outside America. The company has changed its name to Weir-Pacific Valves, Limited, but will continue to be controlled by G. & J. Weir Holdings, Limited, Glasgow.

ALEXANDER FERGUSON (ENGINEERS & BRASSFOUNDERS), LIMITED, Glasgow—Share capital of the company has been purchased by Grampian Holdings, Limited, for £35,000, satisfied by £12,000 in cash and the allotment of 11,500 7 per cent. preference shares and 9,200 5s. ordinaries of Grampian. Profit of Ferguson for 1959-60 was £10,084.

WHITEHEAD IRON AND STEEL COMPANY, LIMITED—Group profits, before tax, are up from £924,376 to £1,446,830 for the year to October 1, 1960. The total dividend is raised by 5 per cent. and a one-for-one scrip issue is proposed. After tax of £715,683 (£319,059) the profit balance is up from £605,317 to £713,147. Final dividend is raised from 15 per cent. to 17½ per cent., making 30 (25) per cent. on the existing £1,250,000 capital.

BRITISH OXYGEN COMPANY, LIMITED—Profits for the year ended September 30, 1960, rose from £3,935,579 to £4,426,993, after tax and outside interests. Final dividend of 10 per cent., as forecast, makes 16 (14) per cent. The increase in profit is attributed almost entirely to sales expansion by oversea companies. Greater turnover at home, it is stated, was offset by higher wages and other costs, particularly in the last few months.

GEORGE TURTON, PLATTS & COMPANY, LIMITED, manufacturers of buffers, springs, dropforgings, rail fastenings, etc., of Sheffield—Despite good business in some directions, shortages of skilled labour and steel supplies are tending to limit output, states the chairman, Mr. Frank A. Hurst. Substantial purchases of steel from the Continent had been necessary to meet scheduled requirements, a matter to be regretted as in addition to paying more for the imported raw material, the extra cost involved was a limiting factor in exports.

REDPATH, BROWN & COMPANY, LIMITED, structural engineers and iron and steel stockholders, of Edinburgh (a subsidiary of Dorman Long & Company, Limited)—After providing £242,719 (£282,823) tax, net profits amounted to £302,806 in the year ended September 30, 1960. The previous year's net balance was £899,154, including £59,466 over-provided tax. An upward trend in output started in the latter part of the year, resulting in some improvement over the previous year's low output, it is stated. The home order-book has improved considerably, and the four works are now adequately committed, but export orders remain much below normal level.

Record Forecast for 1961 Nickel Output

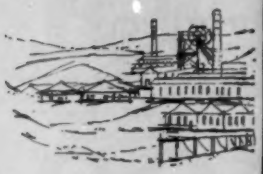
REVIEWING the situation in the nickel industry, Mr. Henry Wingate, chairman of International Nickel Company of Canada, Limited, forecasts that production capacity for nickel in the free world should approach 600,000,000 lb. before the end of next year. This will include the new project of Inco in Manitoba, to come into operation early in 1961, which will have an annual capacity of 75,000,000 lb., but it does not include capacity for 100,000,000 lb. planned by the US Government in Cuba. Three quarters of the estimated free world output will come from Canada alone.

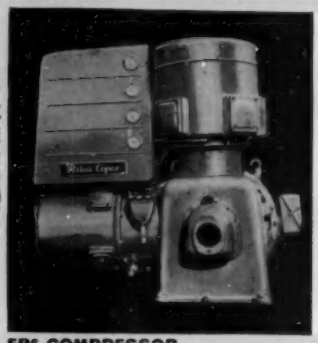
Even by the end of this year consumption of nickel in the free world will have reached a record figure of 500,000,000 lb., an increase of 15 per cent. over 1959, the review continues.

Main factor contributing to the increased consumption has been the use of more nickel in Europe, consumption in North America, which has been the largest nickel market for many years, having this year been below the rest of the free world.

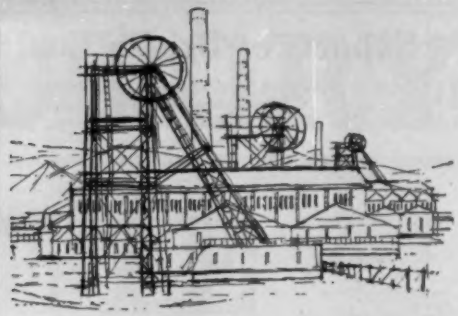
It is estimated that in 1960 Europe accounted for 43.5 per cent. of free world consumption, the US 43 per cent., Canada 2.5 per cent., and other countries the remaining 11 per cent. Stainless steel production provided the largest increase in the use of the metal.

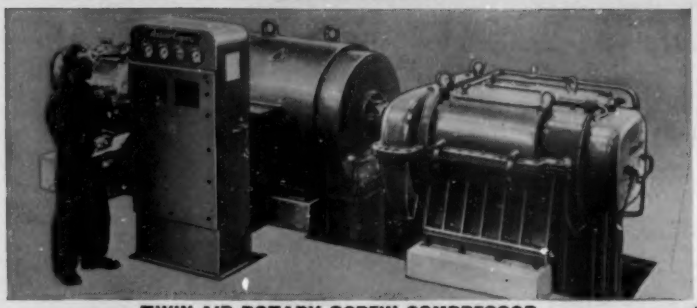
REDUCED DEMAND for anhydrite has led to the redundancy of 17 workers at the Long Meg (Cumberland) anhydrite mine, owned by the Long Meg Plaster & Mineral Company, Limited, Cocklakes, Carlisle. It is hoped to restore the employment position later in the New Year.



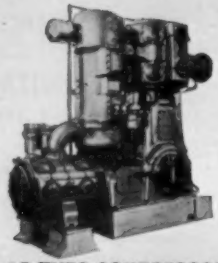


ER6 COMPRESSOR





TWIN-AIR ROTARY SCREW COMPRESSOR



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Exports of British Coal

DETAILS of British coal exports and bunker coal shipments in November, and the totals for the first 11 months of this year and last, are given below.

	Month ended Nov. 30.	Eleven months ended November 30.	
	1960.	1959.	1960.
Categories.	Tons.	Tons.	Tons.
Anthracite—			
Large	10,765	89,091	75,057
Graded	32,098	232,071	255,850
Cleaned smalls	18,677	94,766	188,967
All other	44,510	309,916	306,028
Small coal (including household)—			
Unscreened	11,900	28,421	28,279
Large	45,997	227,155	525,935
Graded	43,326	250,480	395,847
Cleaned smalls	105,783	392,478	1,157,582
Untreated smalls	85,862	738,113	964,510
Other	9,270	199,110	140,462
Gas coal—			
Unscreened	23,670	134,888	180,882
Large	731	2,273	16,397
Graded	35,608	253,857	352,271
All other	2,562	24,015	25,444
Coking coal—			
Cleaned smalls	—	30,286	34,396
Other	22,033	123,123	120,119
TOTAL	492,792	3,130,043	4,768,026
Destinations.			
Canada	3,280	87,109	61,399
Other Commonwealth countries	3,415	9,327	30,152
Eire	80,270	716,167	1,024,305
Finland	7,210	40,094	77,065
Sweden	36,791	171,784	211,311
Norway	9,809	79,608	112,908
Denmark	130,858	910,781	1,421,843
Western Germany	41,550	178,275	379,915
Netherlands	110,421	322,526	836,984
Belgium	29,264	275,087	189,705
France	17,966	194,650	155,340
Portugal	3,815	34,211	114,902
Italy	16,678	71,548	116,235
Egypt	—	20	—
Argentina	—	15,737	7
Other foreign countries	1,465	23,119	35,955
Fuel taken on board vessels engaged in the foreign trade (including fishing vessels) for their own use—			
British flag	10,501	554,320	263,210
Other flags	3,390	45,406	36,269

Exports of Coke and Patent Fuel

THE following table gives figures of exports of coke and manufactured fuels from the United Kingdom during November, and the totals for the first 11 months of this year and last.

Products.	Month ended Nov. 30.	Eleven months ended November 30.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Gas coke	50,169	553,734	611,387
Hard coke	47,872	296,255	453,356
Breeze	29,968	387,143	376,256
Manufactured fuel	7,471	126,659	89,695
TOTAL	135,480	1,363,791	1,530,694

Imports and Exports of Mining Machinery

ACCORDING to Board of Trade returns, mining machinery (other than portable power tools) valued at £87,088 was imported during November, compared with £112,519 in November, 1959. Imports in the first 11 months of this year were valued at £1,013,842 against £1,307,736 in the corresponding period of last year.

The appended table contains figures of export values of mining and well-drilling machinery in November and values for the first 11 months of this year and last.

Destination.	Month ended Nov. 30.	Eleven months ended November 30.	
	1960.	1959.	1960
	£	£	£
Union of South Africa	69,050	529,951	460,095
Rhodesia and Nyasaland	12,046	111,543	164,758
India	102,154	1,358,872	1,072,378
Australia	47,300	270,730	375,729
Canada	27,914	247,944	281,737
Trinidad	32,541	328,855	314,078
Other Commonwealth countries and Eire	70,810	1,159,385	964,504
Netherlands	3,422	188,261	131,474
France	5,461	176,293	155,251
Venezuela	3,921	182,835	98,753
Other foreign countries	216,006	4,101,705	2,722,875
TOTALS			
Well-drilling machinery—			
Petroleum	97,956	4,266,750	2,212,772
Other	40,464	320,451	445,885
Mining machinery (excluding portable power tools)—			
Coal-cutters, power operated—			
Complete	21,143	446,612	448,522
Parts	52,508	621,313	695,708
Conveyors, underground—			
Complete and parts	113,488	1,036,871	940,589
Winders, power operated—			
Complete	3,275	93,969	138,413
Parts	45,219	241,651	305,086
All other	216,572	1,628,757	1,554,657
TOTAL	590,625	8,656,374	6,741,632

South Wales Ports Traffic

TOTAL tonnage through the South Wales ports in the four weeks ended December 4 showed an increase of some 33,000 tons, compared with the corresponding total for 1959. Imports of iron and steel goods were up by 38,000 tons, pitwood and mining timber by 11,000 tons, but ores, other than iron-ore were down by 17,000 tons.

Outwards traffic overall was down, largely because of a big drop—52,000 tons—in shipments of coal, coke, and patent fuel. Iron and steel manufactures were also down by 10,000 tons and tinplate by 8,000 tons.

Totals for the seven ports for the year, with the corresponding 1959 figures in parentheses, were as follow:—Newport, 2,253,854 (2,095,964) tons; Cardiff, 2,223,142 (2,076,328) tons; Barry, 1,207,322 (1,113,371) tons; Port Talbot, 3,357,162 (2,620,437) tons; Swansea, 7,518,547 (6,944,776) tons; Penarth, 343,966 (362,123) tons; Lydney, 26,120 (24,063) tons.

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Imports and Exports of Iron and Steel

FIGURES of imports and exports of iron and steel in November are given in the following tables, based on the Board of Trade returns, and including totals for the first 11 months of 1959 and 1960.

Total Exports of Iron and Steel

Destination.	Month ended Nov. 30.	Eleven months ended November 30.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Cyprus	412	1,523	1,854
Sierra Leone	1,202	8,718	7,300
Ghana	1,216	24,058	20,229
Nigeria	3,561	67,894	54,029
Union of South Africa	7,744	38,316	62,696
Rhodesia and Nyasaland	2,650	19,371	25,468
Tanganyika	1,670	17,808	14,426
Kenya	2,601	23,783	27,221
Uganda	142	3,905	1,411
Mauritius	115	1,599	4,183
Aden	133	2,833	2,509
Bahrein, Qatar, and Trucial States	1,112	7,769	13,515
Kuwait	256	9,528	5,624
India	19,284	191,676	232,573
Pakistan	2,383	41,106	57,692
Singapore	3,719	20,872	21,330
Malaya	1,477	9,573	16,886
Ceylon	2,506	34,124	46,071
British North Borneo	215	2,510	4,067
Hongkong	6,584	62,137	75,815
Australia	29,508	78,734	179,039
New Zealand	24,186	94,152	126,563
Canada	11,537	215,097	188,720
Jamaica	2,737	19,945	22,791
Trinidad	2,540	37,060	35,389
British Guiana	588	6,085	8,114
Other Commonwealth countries	1,967	33,970	30,115
Eire	5,705	45,279	57,554
Soviet Union	2,819	29,713	27,122
Finland	5,867	34,385	46,293
Sweden	12,158	117,625	157,705
Norway	13,418	89,277	111,085
Denmark	7,650	87,288	90,260
Western Germany	6,616	108,377	123,285
Netherlands	9,985	93,093	110,017
Belgium	1,282	33,082	29,513
France	2,037	5,285	9,141
Switzerland	1,059	7,882	13,108
Portugal	1,157	13,863	14,773
Spain	1,522	24,700	41,821
Italy	4,958	42,409	41,141
Austria	404	4,263	4,708
Yugoslavia	2,343	5,168	34,682
Greece	1,308	9,964	18,360
Turkey	2,232	4,746	19,743
Netherlands Antilles	305	3,091	3,119
Portuguese East Africa	246	1,368	4,052
Egypt	1,078	6,148	12,956
Sudan	735	6,508	8,793
Lebanon	212	3,270	1,912
Israel	1,232	12,774	17,558
Saudi Arabia	150	3,000	525
Iraq	13,645	73,084	51,472
Iran	10,095	36,086	70,199
Burma	252	8,062	5,213
Thailand	471	7,375	5,905
Indonesia	1,508	8,315	22,010
China	4,894	50,811	50,613
Japan	13,601	164,674	71,964
Philippine Republic	115	8,142	6,546
USA	10,614	180,552	181,974
Cuba	35	7,407	6,659
Colombia	903	4,903	8,777
Venezuela	7,791	61,460	37,874
Ecuador	290	896	2,769
Peru	749	2,725	6,070
Chile	207	1,363	3,810
Brazil	1,368	21,830	24,730
Uruguay	890	1,745	8,475
Argentina	7,048	184,528	79,165
Other foreign countries	6,153	85,142	123,617
TOTAL	299,152	2,775,804	3,052,698

Total Imports of Iron and Steel

From	Month ended Nov. 30.	Eleven months ended November 30.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Union of South Africa	2,362	26,131	28,003
Rhodesia and Nyasaland	4,690	4,884	11,296
Canada	28,233	18,143	247,944
Other Commonwealth countries and Eire	6,238	12,389	49,649
Soviet Union	480	59,830	28,076
Sweden	5,776	27,840	46,902
Norway	15,928	81,359	145,845
Poland	215	4,673	8,860
Western Germany	5,480	70,188	119,336
Netherlands	13,682	151,380	181,916
Belgium	11,586	20,475	108,824
Luxembourg	1,006	6,223	14,430
France	3,076	22,029	61,242
Italy	73	12,334	21,601
Austria	47	3,778	10,379
Japan	697	2,237	6,636
U.S.A.	10,596	23,284	333,406
Other foreign countries	16,967	11,349	150,145
TOTAL	127,132	558,526	1,574,490
Iron and steel scrap and waste, fit only for the recovery of metal	2,870	2,677	223,971

Exports of Iron and Steel by Product

Product.	Month ended Nov. 30.	Eleven months ended November 30.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Pig-iron	7,681	125,878	136,131
Ferro-columbium (niobium)	7	62	96
Ferro-tungsten	199	1,119	984
Other ferro-alloys	1,771	9,002	11,117
Ingots, blooms, billets, slabs, sheet bars (incl. tinplate bars), and similar primary forms	190	74,748	22,214
Pieces roughly shaped by forging	61	1,334	847
Iron bars, rods, angles, shapes, and sections	327	3,323	1,686
Steel bars, rods, angles, sections, and shapes	63,926	476,785	572,750
Iron plates and sheets	38	1,642	566
Universal plates	3,121	8,758	20,157
Steel plate, 3 mm. and under 4.5 mm. thickness	3,121	37,049	35,280
Ditto, 4.5 mm. or more in thickness	30,124	197,160	317,094
Blacksheets and blackplate	21,492	259,182	269,806
Hoop and strip	10,614	76,030	95,293
Tinplate	43,126	423,177	457,083
Decorated tinplate	444	7,628	5,716
Galvanized sheets	7,325	76,982	76,347
Other (incl. tinned sheets, terneplate, and ternesheets)	3,070	19,842	26,555
Railway and tramway construction material	16,184	153,642	160,737
Wire rods of steel (incl. alloy steel)	5,333	45,428	50,998
Wire	12,436	99,685	111,107
Tubes, pipes and fittings	68,562	677,348	680,134
TOTAL	299,152	2,775,804	3,052,698

PLANS by the Saunders Valve Company, Limited, to set up an establishment at Leeuwarden, Holland, are under discussion with the Dutch Government and the local authorities. The new venture is to provide improved service to customers in the European Common Market. The level of employment at the Cwmbran and Newport (Mon), factories will not be affected by the Dutch scheme and further developments to increase production at both the Welsh factories are being considered.